

Aviation Week

Including Space Technology

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A McGraw-Hill Publication

November 9, 1959

**Boeing Groups
Probe Space
Techniques**

Northrop N-156F Fighter



Reaching for the Moon, Mr Designer?

Here's a tip...Millions of Kaylock® nuts ago, a new aircraft fastener made its bow - the Kaylock H20, first lightweight, high tensile, all-metal, self-locking nut.

Its significant improvement over then-existing fasteners—lighter weight, greater strength, smaller envelope—won immediate acceptance by surface weight engineers and designers.

Today, with a preoccupation on weight and space savings in aerospace vehicles and engines, design engineers depend more than ever on Kaylock nuts. So here's a tip...

If you're reaching for the moon, Mr Designer, reach for your up-to-the-minute Kaylock catalogs first. Chances are, your "brainchild" will get there sooner.

Fastener with a past—Made the Kaylock A20, a favorite choice of design engineers for the past 2 years, the H20 was the first high tensile, all-metal nut using the patented self-locking principle for which Kaylock nuts are famous. Field analyses include:



Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Alloy Steel

Ready to Ship—Here are a few of the Kaylock external wrenching nuts built to meet rigid requirements in weight and space reduction.



H14 Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Alloy Steel



H32 Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Alloy Steel



H24 Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Alloy Steel



H41 Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Alloy Steel



H33 Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Alloy Steel



H190B3 Service Temperature: 1800°F
Tensile Strength: 150,000 PSI
Material: Inconel 600



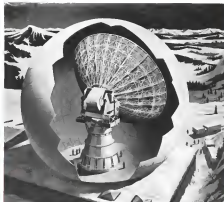
H10 Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Carbon Steel



H31 Service Temperature: 350°F
Tensile Strength: 150,000 PSI
Material: Alloy Steel



Kaylock
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B M E W S

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—The 100-foot diameter radome can with-

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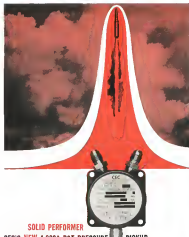
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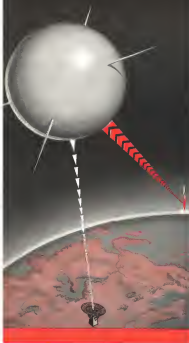
Transducer Division **CEC**

CONSOLIDATED ELECTRODYNAMICS/360 Owen Drive, Pasadena, California

AVIATION CALENDAR

(Continued from page 5)

- Nov. 18-Dec. 4-First industry and government wide training course in Value Engineering & Analysis, Insulated Education Institute, Boston, Mass.
- Nov. 30-Dec. 6-Annual Meeting, American Society of Mechanical Engineers, Chilton and Sheldon Hall, Harris, Atlantic City, N. J.
- Dec. 1-3-Editors Joint Computer Conference, Statler Hilton Hotel, Boston, Mass. Sponsors: Institute of Radio Engineers, American Institute of Electrical Engineers, Association for Computing Machinery.
- Dec. 6-6th Annual Meeting, American Institute of Chemical Engineers, Sheraton-Palace, San Francisco, Calif.
- Dec. 7-8-Classified symposium on "The Plasma Sheath: Its Effect on Communication and Detection," Boston, Mass. Sponsor: Electronics Research Directorate, Air Force Cambridge Research Center.
- Dec. 7-11-National Conference on the Application of Electrical Insulation, Sheraton Park Hotel, Washington, D. C. Sponsors: American Institute of Electrical Engineers, National Electrical Manufacturers Assn.
- Dec. 8-First Aerospace Packaging Symposium, Hotel Eden, Fort Worth, Tex. Sponsors: Society of Aircraft Materials and Plastics Engineers, Dallas Fort Worth Branch of the American Electroplating Society.
- Dec. 17-24-Wright Brothers Lecture, National Harbor Hotel, Smithsonian Institution, Washington, D. C. Dr. Alexander H. Flim (Chief Air Force scientist) will speak on "High Temperature in Flight," and Dr. Frank Thompson and Environmental Technicians." Dr. Flim will receive his lecture on Dec. 18 before the US Cleveland Section, on Dec. 19 before the US Los Angeles Section, and again on Dec. 22 before the US New York Section.
- Dec. 26-30-Sixth King George International Model Flow Vent, Vienna, Ph.
- Jan. 18-19-Sixth National Symposium on Reliability and Quality Control in Electronics, Statler Hilton Hotel, Washington, D. C.
- Jan. 19-26-16th Annual Technical Conference, Society of Plastics Engineers, Conrail Hilton Hotel, Chicago, Ill.
- Jan. 14-20-30th Annual Meeting, American Astronautical Society, Statler Hilton Hotel, New York, N. Y.
- Jan. 19-24-25th Annual Meeting, Institute of the Aeronautical Sciences, Hotel New York, New York, N. Y. Dinner Night Theme, Jan. 26.
- Jan. 18-20-21st Population Conference, American Society for Population Processes, Princeton, N. J.
- Feb. 9-9th Annual Midwest Welding Conference, Illinois Tech Chemistry Bldg., Chicago, Ill. Sponsors: American Research Foundation of Illinois Institute of Technology, Chicago Section, American Welding Society.
- Feb. 25-18th Winter Convention on Military Electronics, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.



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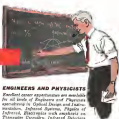
Infrared—which in World War II gave the expert command the power to see in the dark—now holds even greater promise. It may serve to provide early warning of approaching ICBMs if they are launched.

Infrared's singular use in World War II triggered a tremendous postwar effort to find other uses for its unique features. This effort, in which Arco's Crosley Division is a major contributor, has produced many applications in both industry and defense to which infrared is ideally suited.

Because they are so important to the national defense effort, many infrared research programs are classified as secret. But in general, Crosley's work in the field points toward new breakthroughs and continuous contributions in searching and tracking, anti-ICBM detection, airborne early warning and defense systems, reconnaissance, surveillance, anti-submarine warfare and power ranging.

As a result of its progress in these areas, Crosley's team of infrared specialists—one of the best in the country—is gaining the respect of a growing number of contractors.

For more information, write to Vice President, Marketing-Defense Products, Crosley Division, Arco Corporation, 1319 Arlington Street, Cincinnati 35, Ohio.



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reliability



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By **PETER C. SANDRETTO**
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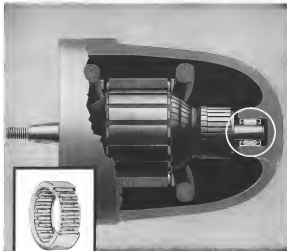
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IMMEDIATE DELIVERY

EDITORIAL

Pacific Jet Future

We have just returned from a 17,000 mi. airfare swing through the Pacific that provided a good glimpse of how the jet transport era will affect the future of this vast basin. It was almost 23 years ago to the day that we left Tokyo that Pan American began the first scheduled passenger service across the Pacific. With four Pratt & Whitney Twin Wasp rated at 1,200 hp each powering the Glenn L. Martin Clans Clipper flying boat, the flying time between San Francisco and Manila was then 58 hr 23 min.

We left Tokyo in one of Pan Am's Boeing 707-320 jet transports powered by four Pratt & Whitney JT4 turbojets producing 15,800 lb thrust each and roared across the Pacific to Los Angeles in 11 hr flying time. A quick connection was made with an American Airlines Boeing 707-120 and we arrived at Balboa's Friendship Airport 4 hr 10 min later for a total elapsed time, including going through customs at Honolulu, of 16 hr 6 min from takeoff at Tokyo to landing at Balboa. Of course we had the help of the prevailing westerly winds that ranged as high as 120 kt on the fringe of jet streams and brought groundspeed up to 690 mph on some leg of the trip. Even so, this was a dramatic demonstration of how the vast Pacific distances are being shrunk and this vast basin finally closely linked with the passenger markets of Europe and America.

President Urges Expansion

Spurred by President Eisenhower's letter directing the Civil Aeronautics Board to develop a comprehensive pattern for air service expansion in the Pacific basin, the Trans-Pacific Route Case that began last week in Honolulu and continues this week in San Francisco should provide the means of providing a modern jet transport network to serve this largest of all air travel regions.

Hawaii, of course, has already been a major keystone of the impact of aircraft air service from the mainland to Oahu. But even a short visit to these delightful islands often convincing evidence that the real air travel boom to this area is still to come. With the Waikiki area already a hotel bottleneck, the development of resort facilities on the other islands is a logical step to expand the 50th state's tourist capacity. With direct jet service from the main island cities as proposed by United, Pan American and Continental this area should prove to be a heavy competitor for the sea seekers now flowing to Florida and the Caribbean.

Last this half a day's jet flight beyond Hawaii lies Japan, which will be one of the most attractive tourist countries in the world once the twin problems of quick access and adequate hotel accommodations are solved. Bulk of air travel from Japan to the American and Europe is still

business travel but with the jets—and the lowered fares they make inevitable—the tourist flow to Japan is bound to accelerate fast. Already the potential of the air cargo market in Japan is being recognized by Pan Am, Northwest and Japan Air Lines with drastically lowered rates and revised flight structures. But upon the advent of the jet-powered freighter, either turboprop or turbojet, will make a radically new contribution to the electronic, textile and optical industries of Japan and the American firms serving the Japanese market.

Untapped Tourist Market

Beyond Japan lies a chain of attractive and equally untapped tourist attractions which stretch along the air lanes to India and Europe/Tapes, although present Chinese handling of American tourists will discourage expansion here. Hong Kong, the incredibly beautiful stopover paradise, Indonesia, where the beaches below Saigon and the bustling country to the north are still relatively unexploited, and the fantasy of Bangkok. It is significant that last year a total of 33,000 round-the-world tickets were sold by airlines. With the advent of the jets this will become an increasing tourist attraction if hotel areas can be found to accommodate the increased flow.

In the South Pacific, plans are already under way to develop Tahiti as a major resort area linked by jet service with Australia and the United States. Tahiti, with its mountains and beaches, offers a wide variety of climatic possibilities within a relatively small area. Moreover, where the French are building a casino and hotels will burgeon as another South Pacific resort although primarily for the Australian market.

Bulwark Against Communism

As Seizo Yanagita, president of Japan Air Lines, was phased out eloquently at the 19th annual general meeting of International Air Transport Assn. in Tokyo, the aim of Assn. is the bulwark against the spread of Communism from the China mainland. In addition to the military power of this bulwark, there must be a bungee jet economies to support its people in physical and spiritual content superior to anything the Communist system can offer. In linking both the military strength and economic growth of this area, jet air transport is destined to play an historic role.

For as Mr. Yanagita told the IATA delegates: "The strong east is out and west is west and never the twin shall meet" is as obsolete as the ecliptic. Today east is west and west is east and no man can tell where one actually begins and the other ends."

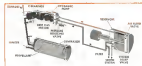
—Robert Holt

FLIGHT HARDWARE...NOW

**VICKERS HOT GAS
AUXILIARY POWER SYSTEMS**
for missiles and spacecraft

CONCEPT

Vickers piston motors — as used in virtually all existing commercial and military aircraft — are now modified to operate efficiently as propellant generated hot gas, or bleed gas from the main propulsion system. Minimum weight is achieved by mounting the hot gas motor "shaft-to-shaft" with a Vickers piston hydraulic pump in a common housing. The motor/pump, a simple gas generator, hydraulic resistor, filter, and relief valve are integrally mounted to form a complete Auxiliary Power System in a compact package.



DEVELOPMENT

Production line Vickers hydraulic motors have been operating on hot gas for over 2 years. Units have run on gases as hot as 2300°F without modification.

The present flight hardware was built and tested after an intensive prototype development effort. Test program motor/pumps have accumulated over 100 runs each for 1 minute of operation cycle. Since the current development program is aimed at meeting known APS requirements, no limits have been established on the operating cycle duration for this type of equipment.

CONCLUSIONS

Performance and reliability goals for this concept have been met successfully. A complete hot APS package in the 2-8 horsepower range, shown above, is available within 90 days. Customer specifications for these and larger systems are invited. Write for Bulletin A-5243.

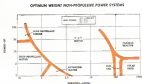
AERO HYDRAULICS DIVISION
VICKERS INCORPORATED
DETROIT 32, MICHIGAN



APPLICATIONS

Because of the increasing scope of APS applications, Vickers conducted a series of studies to establish criteria for APS selection. Recent study results (published in March, 1969) indicate that for short duration operation, hot gas motors offer the best weight advantage in the 1 to 30 hp range. See curve below.

Attractive reliability and early delivery resulting from extensive use of proven hardware may extend the application of these systems to an even greater range of second and third generation missiles and spacecraft. Additional advantages include low speed equipment (up to 10,000 rpm), convenient ground checkout, growth potential, and no alert time required.



WHO'S WHERE

In the Front Office

Dr. Frank Press, California Institute of Technology, directed a director of United Technologies, Inc., Pasadena, Calif.

Robert W. Foley, a director, Standard Aerospace, Inc., Tulsa, N. H. Mr. Foley is vice president and general manager of Standard's Propulsion Products Division.

William A. Ruffe, president, Space Corp., Garland, Tex.

R. C. Foley, vice president and group vice president, Bendix Avionics Corp., Detroit, Mich., and a member of the corporation's administration committee. Mr. Foley has been in general operations of the Pacific Division, and also will represent Bendix's Compton Division.

Leslie F. Gluck, a vice president of Raytheon, Inc., Melbourne, Fla., and manager of the Florida Division.

Mr. G. H. Hays, Raytheon's (USA) chief administrative vice president, South West Research Institute, San Antonio, Tex. Also Dr. Lester Rupp and Henry Karp, technical vice presidents.

J. T. Gault, senior vice president, and **James Gault**, general sales manager, International Avionics Corp., El Segundo, Calif.

Kenneth M. Engel, vice president and chief electronics corp., New York, N. Y.

George E. Kunk, vice president and manager, United Air Lines, Inc., New York, N. Y. Would succeed Mr. Kunk in a similar vice president engineering and maintenance.

R. K. Hughes, vice president and general manager, Raytheon, Inc., San Diego, Calif. Would succeed Mr. Kunk in a similar vice president engineering and maintenance.

Charles W. Hays, vice president and general manager, South West Research Institute, San Antonio, Tex. Would succeed Mr. Kunk in a similar vice president engineering and maintenance.

John P. Schmitt, vice president, Allied Products, Inc., Fort Worth, Calif.

Thomas P. Schmitt, Jr., vice president and assistant to the president, West Coast Avionics, Inc.

H. C. Hays, vice president and director of operations, Standard Wire and Cable Co., Los Angeles, Calif.

Arthur F. Peltzer, vice president and chief engineer, Avionics Corp., New York, N. Y.

Joseph C. Cullen, corporate manager and **Charles C. Cullen**, corporate manager, Northrop Corp., North Hollywood, Calif.

Walter P. Stroud, director of Mr. Cullen as manager of the company's Aerospace Division.

Honors and Elections

Edward Turner Jones elected controller (General Affairs) Member of Air Force of the United Kingdom, has been elected deputy chairman of the NATO Advisory Group for Aerospace Research and Development. Mr. Jones is the first deputy chairman of NATO.

T. T. Wadell, administrative assistant to the president of Trans-Canada Air Lines has been elected president of the Air Industries and Transport Association of Canada.

INDUSTRY OBSERVER

► **Project Low Blow**, Navy program related to the design of an intercept aircraft capable to be launched from Polaris submarine launching tubes and used in a coordinated configuration with the fleet ballistic missile, has indicated its feasibility in the selection of model vehicles from tube. Missile would make a high-altitude, high-velocity run past of the war to its target and then make its final approach in low level. It would use a booster in the early part of its flight. Studies have been made under the supervision of the Office of Naval Research.

► **Selection of an astronaut panel** for the USAF Dryden F-4 Phantom II space research vehicle has been completed. Selection procedure was similar to that used in National Aeronautics and Space Administration's Mercury program. Astronaut selection programs also are under way for several other manned USAF space programs.

► **Navy's second attempt** to capture the world altitude record now held by the Soviet Union (AW Oct. 12, p. 21) will be made with a specially modified version of the McDonnell Aircraft Corp.'s F-4H brought off neither fighter. Principal modifications will incorporate new engine inlet design. First attempt to surpass the Soviet record with the F-4H reached 66,100 ft., which was higher than the 54,657 ft. reached by the Soviet record. Soviet pilots but less than the 19' margin required by Federal Aviation Administration regulations to set a new record. Another F-4H is expected after the McDonnell will only last year with new model General Electric J79 engines which will give this aircraft an altitude capability of more than 100,000 ft.

► **Recommendation of a fighter choice** for the Japanese Air Self Defense Force was submitted to the defense agency last week by Gen. Mitsuo Genda after an extensive evaluation at Edwards AFB, Calif., of the Grumman F11P-1F, Lockheed F-106, Northrop F-105 and Convair F-102. Next step in the program, recommendation to Japan's Defense Council by the defense agency, is expected by Nov. 17, with the final choice coming by the end of the month.

► **Recent Naval Research Laboratory tests** indicate the feasibility of air-air communications at microwave frequencies over distances considerably greater than line-of-sight range. Radio signals are propagated through "ducts" found over the ocean which are produced by temperature and pressure inversions. Ducts usually are found at an altitude of 5,000 to 7,000 ft. plus additional tests in the South Atlantic during next several months, using radio frequencies of 210 mc.

► **Two transport versions** of the Mach 1.8-20 bomber have been prepared at Air Force by North American Aviation, Inc. One model, which would not require any change in the external configuration of the aircraft, would seat 60 people. The other version incorporating an enlarged fuselage would carry 100 persons. Range of the smaller aircraft would be 3,500 mi. plus reserve. It would weigh approximately 100,000 lb. less than the B-70 bomber configuration.

► **Army competition** for an Electronic Environmental Test Facility, to be established near Fort Belvoir, Ariz., to evaluate problems of operating radar and communications equipment under tactical conditions in the face of enemy jamming, has been narrowed to four finalists. These are teams headed by Ford, Plessey, Pan American World Airways, Systems and Vision. The first are to submit test estimates by Nov. 12. Pan American, which together with Radio Corp. of America operates the Atlantic Missile Range, is considered a serious contender.

► **Naval Air Development Center** is expected to order a Visual Integrated Presentation (VIP), electro-optical integrated cockpit display developed by Chicago Aerial Industries, for flight test evaluation next spring. The novel display optically combines direct view of the cockpit with a video image, with radar scope presentation and the display of cockpit flight instruments (AW July 6, p. 110).

USAF Program to Sell Facilities Nears Stage for Actual Exchanges

Washington—An Air Force program to sell a number of USAF-owned plants to the contractors comprising them is now reaching the point of actual exchanges in ownership. Plans for the program were initially laid down in 1957.

Under present planning, first two facilities to change hands will be the Martin Marietta Cold Plant, occupied by Douglas Aircraft Co., and an installation operated by General Electric Co. in Johnson City, N. Y. A number of other proposals are under negotiation between the Air Materiel Command and the individual firms involved.

An Air Force official said a majority of the plants in World War II facilities designed for mass production which have limited uniform facilities under present conditions where aircrafts demand high unit cost savings within an average period of planned.

USAF Inventory

At present the Air Force owns 44 active noncombat facilities, including 11 aircraft plants, eight engine plants, five heat exchanger plants, five waste plants, five missile engine facilities and six fuel plants plus a number of miscellaneous facilities including liquid oxygen installations.

Most of the airframe and engine plants probably will be sold, it is possible, with the Air Force retaining portions of the newer facilities such as the liquid oxygen plants and enough of the older installations to ensure that the U. S. retains an adequate capability to maintain old defense production.

In addition, Air Force hopes to sell a number of USAF facilities located within plant areas owned by private companies.

In both cases facilities the Air Force hopes to sell to the contractors have been declared "excess to ownership" by USAF procurement and production officials at Air Force headquarters in Washington.

The "excess to ownership" classification is applied to facilities where defense production is still under way, although most often on a limited scale where its operation has become uneconomical in USAF.

Once a facility is placed in this category, Air Force headquarters instructs the Air Materiel Command in Dayton to contact the private producer in the plant and offer it for sale at "a fair market price."

If, in one Air Force spokesman's phrase, the contractor replies with a negotiated price that "reflects good faith on his part," the negotiations are continued

by AMC and, after tentative agreement has been reached, forwarded through USAF headquarters and on to the respective Federal Service Commission, House and Senate, which by law must approve any sale of USAF property with a value of over \$25,000.

After this approval is obtained, the proposal itself is passed along to the General Service Administration through the Army Corps of Engineers for final negotiations and disposal.

At present, only the Douglas and General Electric proposals have been transmitted from the General Service Administration back to Air Force headquarters, although a number of letters have been transmitted to other firms by AMC.

Proposed sale of the Douglas Santa Monica facility has been approved by Congress and the committee and is the process of being referred to the General Services Administration.

Sale of the Johnson City, N. Y. plant in General Electric has been approved by the Senate committee but must still clear the House.

If, after receiving the AMC letter, a contractor's reply and suggested sale price does not indicate a consensus on his part to negotiate, the Air Force must then continue its inventory of the plant and its facilities and the contract rights have expired and it can be disposed.

U. S., Turkey Plan Jupiter Sites

Washington—U. S. last week for north announced plans for deployment of a Jupiter intermediate range ballistic missile squadron at Ankara and in a related move, proposed a gradual withdrawal of Strategic Air Command fighters from Germany.

In another move, the Air Force also acknowledged that the number of Thor IRBM squadrons have been reduced from the originally planned 12 to six, as reported earlier in *Aviation Week* (AW Oct. 26, p. 25). The new-scale of four IRBM squadrons would have an impact on the contractual U. S. as a backup unit the other firm are being deployed at bases in Great Britain.

In maintaining the bilateral agreement to establish a Jupiter squadron in Turkey, the Defense Department and detailed arrangements for the base have been completed. The base will be occupied until the U. S. has a major reason before the general withdrawal is to lessen the impact on the Turkish economy. It is estimated that U. S. forces and dependents would about 540 family members in Germany.

rated "excess of need." "Excess of need," a classification one-step below "excess to ownership," is a retention designation before the Air Force can actually attempt to sell the plant to any potential contractor other than to the tenant only.

Potential Leaver

An effective lease, however—and one that USAF says it has not yet explained—could be the impetus to impel negotiations to a company that, if it relates to seventh, eighth, or ninth, no further contracts will be for refurbishing and maintenance. The plan is to phase out the "excess of need" category which entails a complete halt to production.

Air Force procurement officials have said that the sale of a facility either by lease or by outright purchase will be possible in all parties concerned. It entails a minimum disposition of the labor and management forces involved and, in addition, permits the employer to transfer his own labor of operations in a plant to another contractor in other defense work which he probably could not perform to long as the plant remained under USAF ownership.

In addition to the firms which have been placed in the "excess of need" category, "excess to ownership," most other plants have been appraised for classification of "excess to need." In Air Force headquarters since all production has come to a halt. The largest of these is the Ford Chicago plant which the defense contractor 177 jet engine plant once produced.

It is estimated that the "excess to ownership" category will be approximately 100 plants. The "excess to need" category will be approximately 100 plants. The "excess to ownership" category will be approximately 100 plants. The "excess to need" category will be approximately 100 plants.

U. S. Nuclear weapons for the missiles will remain in U. S. custody.

The Defense Department and the Turkish side are agreed that the number of Thor squadrons will be reduced from 12 to six, as reported earlier in *Aviation Week* (AW Oct. 26, p. 25). The new-scale of four IRBM squadrons would have an impact on the contractual U. S. as a backup unit the other firm are being deployed at bases in Great Britain.

The proposal for withdrawal from the three SAC bases in Germany has been presented to the Moroccan government, and after arrangements have been completed, it is expected that the closing of SAC bases and removal of personnel will be accomplished by steps over a period of several years. A major reason before the general withdrawal is to lessen the impact on the Moroccan economy. It is estimated that U. S. forces and dependents would about 540 family members in Germany.

The first of the German Air Force Starfighter is scheduled for completion in October, 1961. Each country intends to build 100 planes, but the German side has been planning to build 66 F-104Gs will be built in the U. S. Lockheed expects to have the first of this production run ready by August, 1961.

Belgium and the Dutch have passed a

Special Training Areas Programmed by SAC

Washington—Establishment of seven special training areas for Starfighter Air Corps squadrons is being programmed by SAC and the Federal Aviation Agency.

The training areas are scheduled to begin throughout the country will begin on Nov. 25 with Boeing B-70 and B-52 jet bomber flying the new routes which will be 200 to 300 miles and run in length up to 100 miles. The announcement is made by the Air Force headquarters where the tests will be made.

Termed the "Old Bunker" routes, the military flight paths will start at a maximum altitude of not less than 10,000 feet above the highest terrain and will operate in 10,000 ft and higher according to FAA.

Designed to increase SAC's all-weather proficiency, the routes are to be used primarily over sparsely settled areas, from population and airport centers. They will be used in an average of about 10 to 15 days during two 5-10 periods five days a week. The schedules will avoid peak civil air traffic periods.

The announcement and that of current business and military operations will be immediately followed by the probability of SAC readiness in their own SAC aircraft. The "Old Bunker" routes also will maintain an approximate speed of only 100 mph to avoid the possibility of disturbance from sea bases.

Germany and Canada Seek Standard F-104

Bonn—Current discussions between West Germany and Canada officials in Ottawa are aimed at bringing close agreement between the two countries on a standard version of the Lockheed F-104.

The German configuration, the F-104G is designed for a dual bombing intercept mission. The Canadian version, the CF-104, is designed for intercept and the bombing mission. It would be assigned to the NATO command as an intercept or equipment for the two CF-104s now stationed in Germany.

The first of Canada's F-104s is due off the assembly line in April 1961. The first of the German all-weather Starfighter is scheduled for completion in October, 1961. Each country intends to build 100 planes, but the German side has been planning to build 66 F-104Gs will be built in the U. S. Lockheed expects to have the first of this production run ready by August, 1961.

Belgium and the Dutch have passed a

Martin Leaving Airplane Business

Martin Co. is no longer leaving any new airplane business, though there is a question of whether the company will be able to do so in an airplane such as the one in the stage of Dyna Soar.

This was in contrast to statements at Martin's last in last summer (AW June 5, p. 47), but the acquisition of the PMA jet engine transferred to a change in Martin's third quarter report, Chairman George W. Baker noted that.

"It [Martin] is to be put in the position of an airplane business. It does not expect to produce any more airplanes. The transition to the aerospace, missile, electronic and nuclear fields is nearly complete."

Speaking to the Boston Society of Scientific Analysts last week, Baker outlined the policy but pointed out Martin was in the defense business more than ever. "The fact of what was has been classified as the old airplane business has been the fact of their new business," Baker said.

He also declared the merger of:

- Negotiations with Lockheed, McDonnell and Telefunken for formation of a new company are almost complete. It would be owned half by Martin and half by the German companies. Martin is interested in Telefunken's commercial defense capabilities and also in production for the West German for NATO and perhaps of the air handling field in West Germany and in.
- More than 80% of the company stock of General Dynamics Equipment Corp. has been acquired in the last few months. A substantial purchase of General Dynamics' S200 powered tank, said to the public last summer, also has been made.

Baker said no merger is planned now since he feels the merger in Martin and General Dynamics will be completed in the near future. The merger of the two companies had shown interest in merging with GEC, but that move was contemplated.

Further Work in Progress to Arrive at a Standard Version of the F-104 for Europe

Bonn—Current discussions between West Germany and Canada officials in Ottawa are aimed at bringing close agreement between the two countries on a standard version of the Lockheed F-104.

The German configuration, the F-104G is designed for a dual bombing intercept mission. The Canadian version, the CF-104, is designed for intercept and the bombing mission. It would be assigned to the NATO command as an intercept or equipment for the two CF-104s now stationed in Germany.

Little Joe Shot Tests Mercury Escape Unit

Washington—Second hot-fire test of the 2,000 lb Mercury capsule was fired by a Little Joe booster rocket in a successful test of the pilot escape system under maximum aerodynamic loads.

The capsule was hoisted to 33,000 ft altitude where the escape rockets mounted on a 16 ft tower above it were fired. Three seats launched for one second, sending the capsule on a parabolic arc to an altitude of 33,000 ft and a point several thousand feet from the path of the Little Joe booster which was launching the Atlas vehicle to be used during the manned flight.

The escape tower was actuated after a 25-second coasting interval and a subsonic drag chute was deployed after another 10 sec. Three minutes after separation at about 10,000 ft, the main chute was inflated to reduce the rate of descent to 10 to 12 ft per second.

After ejection, the pilot chute was used to send acceleration information to the ground. Data indicated stresses in the structure and type of aerodynamic motion during the separation and recovery phases.

The first Little Joe Mercury capsule flight last Oct. 3 was a successful test of the eight engine booster with all of its four F-104 and four Rocket engines flying. Over the second flight, a short duration was desired and two of the F-104 engines were dropped.

Capable of seven sec complete 45 min after launch. When the main parachute deployed, a smoke bomb was ignited and a landing light turned on.

Soviet Rocket Plans

Washington—Soviet astronaut Boris Yeliseyev has announced that more rocket details will be sent to the moon and the moon will be sent to the moon. He said he would be sent to the moon to become a permanent resident. He said he would be sent to the moon to become a permanent resident. He said he would be sent to the moon to become a permanent resident.

Irvine Pushes 'Fresh' Space Approach

By Edwin J. Ruffin

Wichita, Kan.—The United States must drastically restructure its defense and government research organizations and assign greater responsibilities to industry to beat the Russians in the mobile and space race, Lt. Gen. C. S. Irvine, (USAF, ret.), stressed here last week.

Speaking during the 1959 annual midwestern meeting of the Institute of the Aeronautical Sciences, the Irvine deputy chief of staff for aeronautics, headquarters USAF, now vice president-planning, Aero Manufacturing Corp., said it was obvious that the U.S. cannot maintain an efficient and economical military posture in the years ahead if we insist on adhering to tradition and policies as old as George Washington.

Irvine outlined several broad areas requiring a fresh and enlightened approach elsewhere he noted "we will continue to look at the tail lights on the Russian submarine always missing the corner ahead of us." The U.S. has saved seven times as long as the U.S. was ahead of the Russians but two years ago they had almost achieved parity with the U.S. in important missile and space development and now he estimates they are ahead of us in certain areas.

He called for essential retooling, a simple and positive military and civilian command structure in the first and most important basic area. Acknowledging the need for a strong, well organized and well-financed National Aeronautics and Space Administration for supervision of

parallel scientific studies, he contended that NASA must contain within itself essential and authoritative elements of military management to insure proper control and direction of the top scientific effort. He stressed that NASA's essential role should be in basic and applied research and the staff be paid if necessary, to carry out the research—much as we are in developing land, sea, and air programs.

Irvine declared what he viewed as a tendency in governmental organizations particularly not seen since NASA, is to try to tie up a commander's progressive rights, covering in 18 cases' joint work, if it is to work on one all-around piece of defense business. He criticized this restrictive process making the government fail to give complete freedom to the military, and certainly not enough in several business positions.

He called it anomalous that the U.S. must not permit duplication in government space, missile, depth or labor. He said that the creative and productive efforts best produced in a free competitive economy. Government organizations should establish the requirements and the direction of the basic research effort, the development, engineering, production, engineering and finally the process manufacturing of the hardware will have to be handled by large and small industrial corporations according to Gen. Irvine.

He said he felt, he said, he could see the need for a combined and unified command below the Russian structure and they would not work in this. He said a decision can't be made by the Russians in carrying their work (Irvine added).

Wichita is the site of research and development programs between NASA and the Advanced Research Projects Agency and the three military departments. He said, we have had the strongest effort and great deal of effort on our part most capable people has not been put to advantage. The real U.S. emphasis in the space field has been with private industry, he said.

Within NASA and at the top of the Department of Defense, Irvine noted that we must quickly to a modern streamlined organization growth in research in defense and area of people. A simple modernized and well equipped military to be in and out organizations, with top civilian in civilian grade higher grades and higher pay, should be able to produce appropriate results.

Next, in our conference, is need for a

single military service, with functional divisions for land, sea and aerospace, a single military command, a single military commander responsible to the present chairman of the joint chiefs of staff, speaking directly to the secretary of defense. Irvine tagged the present joint chiefs of staff organization as "a very fine building with a very shaky foundation" and its chairman pointed out to the congressional committee in an earlier conference, the head of Department of Defense, and not the chiefs.

World Command

Under the present military commander of the new organization, there should be a new commander for each of the three functions, on a world-wide basis. Single world-wide commands for the strategic air function and for the air defense function should be created and appropriate commands are essential for operations on the surface and below the surface of the sea and finally, for all troop operations on land, he said.

Secondly, separate government production and support operations should be set up for each of the three major functional areas, in order to permit proper chain of command.

On-line transportation was another function he said, and finally, the approach in the past, he said, has been the tradition for the Air Force and the aircraft industry to provide

developments in civil air transportation on the basis of structural "full-on" for military efforts. We must, he said, direct a much greater portion of our best scientific, engineering and industrial efforts toward satisfying our transport requirements. On the long term, it is essential when we produce and operate Mach 3 transports. It is mandatory that we optimize propulsive and body structure considerations into ideal configurations to permit economical and efficient transportation at speeds to Mach 10.

Irvine noted that the civil transport requirements of the future present an opportunity for the civilian aircraft, in civilian aviation, manufacturing and engineering organizations to achieve requirements for more effective movement of people and material and create fulfillment of these needs.

For example he noted, we have, with the advent of jet transport operations, developed expenditures amount of moving people and cargo from Russia. In Russia, however, our methods of transporting these loads from home and office to remote outposts and from remote to home and office on arrival, are antiquated and inefficient and act on a par with the transportation efficiency we meet often in the future.

It is also imperative that strong and positive action be taken to emphasize development of air traffic control systems and flight control systems—civil and military—single unified command. In these areas it is imperative that serious research and development tasks be performed by personnel holding military service or National Guard commissions so that "the 5000 transition from private to war effort" can be accomplished.

Putt Heads IAS

Wichita, Kan.—Lt. Gen. Donald E. Putt, (USAF, ret.), has been elected president of the Institute of the Aeronautical Sciences for 1960 succeeding William Littlewood, vice president and immediate past president. At the time, it was reported that he was doing the institute's National Museum Studies.

Gen. Putt now is president of United Aircraft Corp., Merle Park, Calif., a United Aircraft Corp. subsidiary.

In another article, J. Earl Schuler, Boeing Airplane Co. vice chairman, who retired from the company earlier this year but retains his title, was honored by the institute for his contributions to the aerospace industry and the U.S. during the past 31 years. Schuler joined Sherrill Aircraft Co., predecessor of the Boeing-Wichita Division, in 1924 and for many years was president emeritus of the division and vice president and director of Boeing.



Rocketdyne Tests 400,000 lb. Thrust Engine

Research and development solid rocket in the 400,000 lb. thrust class is shown in static fire test stand in this photograph. Rocketdyne Field Propulsion Laboratory, Azusa, Calif., designed R-1 for the company, a jet scheduled for use specific vehicle of present, tests order on combination, turbo-motor and solid rocket operation.

for all main duties concerned by a single Department of Defense contract order over three on traffic control circuits. IAS also develops in air transport work also discussed by aviation pioneer Grover Loening, who assisted that passage in an freight cargo plane, the 511th Air Force Reserve Group, obsolete even before the start of this project was initiated.

Loening envisaged costs of air cargo planes into bulk shipment fields in direct competition with seagoing freighters. He pointed out that even current types, such as the Lockheed Super Hercules, Convair CL-44 and Douglas C-119 helicopters could load hundreds, such as well as faster directly from processing plants—or even when loaded on planes in systems of getting there—of a cost of approximately 44 cents per ton-mile on a trip of 2,000 mi. to South American countries. Total cost would be approximately \$117 per ton, or 24 times the cost of shipping it via freighter. But some benefits might be obtained in such shipments even at increased cost considering that time could be approximately 64 hr compared with about 22

days that it would take in freighter. Loening said that in 1970, such bulk, as well as general cargo, will be shipped. He believes that the 1975-type cargo plane will be able to deliver in one year at much costs as a 30,000-ton freighter in the same period.

Loening saw the air cargo transport at 1970 as being an eight per cent faster powered airplane, capable of carrying 100,000 loads in 480 miles. With this performance, the airplane would be capable of providing a cargo lift of approximately 325 million tons miles per year on the basis of 5,000 hr utilization, or more than 100 times the air lift capability of cargo planes of just 15 years earlier. Fast consumption would be on the order of one-quarter pound per hour per period of thrust.

Loening noted, R-100-3980, he envisaged a Mach 3 cargo plane, capable of carrying 100 tons payload providing about 1.275 billion ton-miles per year on the basis of 5,000 hr annual utilization. Its freighter could be 10,000 tons in 20 mph, operating 5,000 hr, annually, would provide a total of only one billion ton miles annually, he said.

Uniform Cost Control Principles Adopted by Defense Department

By Katherine Johnson

Washington—Defense Department last week released a uniform set of cost principles applicable to all defense contracts—except the competitive bid contract in which only the price is of governing interest.

Until now, Defense Department has had two sets of cost principles applicable to two limited areas of contracting—cost to cost reimbursable contracts—generally research contracts—and select to cost fixed-price contracts, which to cost fixed-price settlements. There has been no conflict guide line as to what is and what is not allowable cost for the major area of negotiated fixed-price contracts. The new principles apply to all three areas.

The uniform set of cost principles over five years in the making, was adopted and released on the eve of the most thorough-going congressional review of military government policies since the end of World War II. The chairman of the House Committee on Armed Services, the House and Senate Armed Services committees to study and evaluate military contract practices (AW July 6, p. 29). House Armed Services, as well as House Appropriations Committee, has in the past, prodded Defense Department for action steps to curb excessive cost factors in all negotiated contracts. Defense Department, explaining the long delay, pointed out that it has had cost principles for cost type contracts and for termination settlements, "saying," "The extension of cost principles to the fixed-price area is a very complicated

and controversial subject. It has been necessary to take into consideration the through held views of many parties at interest, including those of industry. The resolution of these areas of controversy has been difficult and hence, progress has been somewhat slow."

The department also noted that it was raising its cost ceiling in the face of industry opposition, and commented, "Industry has traditionally opposed one of our regulations which set fairly specific costs in various allowable contracts that the government should allow all actual costs of doing business. For this reason, industry is opposed generally to most of the difficulties we have presented. Industry is also opposed to the attribution of cost principles in the fixed-price area."

Defense principles demonstrated the new set of principles as "generally carrying out past policies...lightening up in some areas and tightening up in others." They give the equivalent of coverage and "the elaboration of detail" as the notable features of the new cost guide line.

Policy was the most significant aspect appeared to be that the general authorization for the government's reviewing the cost-as part of the contract, a company's basic research not directly related to a specific contract. This is in line with the Administration's policy of encouraging scientific research in private industrial firms, rather than forcing government agencies to finance research in the field. While so called "blue sky" research, if "across the board," is an allowable defense contract

cost, hardware development cost must be directly related to a specific project.

Here is the restriction, which is spelled out on government financing of basic research as an indirect cost on a defense contract.

"The reasonableness of expenditures should be determined in light of all pertinent considerations, such as previous contracts research and development activity, cost of past programs and changes in science and technology. Such expenditures should be permitted in a broad planned program which is reasonable in scope and well managed... advance agreements... are particularly important in this situation. In recognition that cost sharing of the contractor's independent research and development program may provide motivation for more efficient accomplishment of such program, it is desirable in some cases that the government bear less than an allowable share of the total cost of the program."

In the area of fixed-price negotiated contracts, Defense Department laid the introduction of a set of scientific cost allowance and disallowance principles which will be the subject of a report in the long run. It is anticipated that "steps we have not provided specific guidance in the past, these new principles will at least in some instances result in reduced recovery by contractors for certain particular items of expense."

The department said that the new principles "will not materially change our operations in the area of cost reimbursement contracts—although there have been major cost controls for some years."

One of the new 28-page set of cost principles by government contracting officers is undoubtedly generous. It will become operative as of July 1, 1960. Existing contracts may be amended to bring them into conformity with the new principles the department said.

Industry Wage Boost Debated in Washington

Washington—Initial steps leading toward possible increases in the minimum wage in the aircraft and electronic industries will be taken at a meeting Nov. 19 between industry, labor and Labor Department representatives.

A questionnaire on prevailing wage scales, which the Labor Department plans to send to hundreds of firms, will be discussed at the meeting.

The Walsh-Healey Act authorized the government to set the minimum wage for defense contractors. The current \$2.65 an hour minimum wage for the aircraft industry was established in 1942. A minimum rate has never been set for government electronics and aerospace contractors.



Sikorsky Unveils Rear-Loading HR35



Rear-loading version of its HO4S-1 twin-turbine helicopter designated the HR35-1 was demonstrated by Sikorsky Aircraft last week to Royal Canadian Air Force officers at Ottawa. Both Sikorsky and Vertol Aircraft are competing for a Canadian order for as all the drill land-attack helicopters and both companies are prepared to turn out at least a portion of production in Canada through Canadian affiliates (AW Sept. 23, p. 21). Moreover, shown in these photos also has been demonstrated by the U. S. Marine Corps. The HR35 shows the same rotor system and General Electric T38 propellers as the HO4S-2. Dimensions of the new four-blade rotor on a vertical axis section, are 70 ft. high and 70 ft. wide.

Eagle Missileer Competition

Washington—New Bremen of Wagona, Ga. has decided to break out its requirement for the Minotaur, a new carrier-based 50,000 lb gross weight in cost, at long range Eagle air-to-air missile. Shortage of funds for the program and the short-life time required to meet the Eagle's timetable were talking factors (AW Oct. 26, p. 25). However, missileer conference is now scheduled for Nov. 16, in Washington.

Report by proposals to advance manufacturers not expected to be issued by the Bureau of Weapons already distributed. Letters have been sent to prospective bidders with an outline of the requirements for the new missile. Request for proposals have been circulated among several engine manufacturers.

Bureau of Weapons is looking toward a completely new missile, but it is apparent that cost will be a factor in the light of present program situation. Navy may be forced to use its existing assets. A modified Constant ACP has been considered previously in this category, but it would have to be scaled up to meet the requirements. Navy has reviewed all the new carrier-based Minotaur, which probably will involve large scale launching capability, greater quantity of aircraft equipment, increased engine thrust and increased reliability of action. Another requirement is the mounting of an Eagle missile.

Another interest the Bureau of Weapons is considering is a modified Douglas A-1. This aircraft is two times—75,000 lb gross—for the new requirement but would be less expensive than the ACP.

Sidewinder Hits Target in Overcast

Tyndall AFB, Fla.—USAF's William T. B. III, its seniorst worldwide weapons expert, was highlighted in the performance of the Lockheed F-104 Starfighter, participating in the first time, and the overall competitiveness of the 12 competing teams while being in what the judges considered the worst weather that could normally be expected for aerial combat exercises.

Effects tests of the F-104, with its wing-mounted bank of two Phalanx General Electric GARR-Siden under infrared homing missiles, in performing the air defense mission has been questioned because the performance of infrared guidance systems is degraded by clouds, fog and aircraft. The two participating F-104 teams, however, three times scored direct hits on target drones in heavy clutter and consistently scored near misses well within the lethal radius of the proximity-fused Sidewinders' 13 ft radius (AW Oct. 26, p. 32).

USAF-Navy Reviews Beech Mach 2 Drone

Wichita, Kan.—A test capstone waterjet program is now being carried out by Naves and USAF technical personnel on the new March 2 Mach MKDDB-1 low cost expendable target drone being test-work. Winner of a joint Navy/USAF design competition (AW No. 25, p. 32), the waterjet-driven WS-406L, is powered by a Rocketdyne liquid propellant ram rocket motor, weighs 550 lb and is capable of achieving 10,000 ft altitudes. It is scheduled to become operational in 1992.

The fifth program runs also was carried out simultaneously on the popular device. Each K128-1 is produced

Production KTH-1 has been successfully launched in the first 1 lot off the Test Coast. Arms, also has successfully used the target in both of its Ratthem Hawk, an increased network system.

News Digest

North American test pilot Scott Crossfield last week made an emergency landing in the X-15 aircraft shortly after an explosion in one of its rocket engines caused severe structural damage. A fire warning light came on seconds after the X-15 dropped from its 85,312-foot climb at 45,000 ft.

First production Cessna T-37B, more powerful version than jet primary, but not as agile, with Aer 1000, was killed out by Cessna Aircraft's Military Aircraft Division at Wichita, Kan., late last

work. In addition to pump production contracts on T-37B, the company will participate in a retrofit program which will modernize hundreds of T-37A's to the latest configuration.

Follow-up contract for Republic I-305 Thundershead light-bomber after fuselage sections and ailerons valued at more than \$16 million, has been acquired by Beech Aircraft Corp., Wichita, Kan., bringing to approximately \$10 million the total dollar value awarded the company on the I-305 program and extending this work to mid-1961.

Orders worth \$14 million for three Comet 4C turboprop manuscripts has been placed with the Highland Aircraft Co. Ltd., by Compañía Nacional de Aviación, Mexican affiliate of Pan American World Airways. Delivery of the first two is planned for December, the third is scheduled for delivery in mid 1990. The order brings the total number of Comets ordered to 39, of which 16 have been delivered.

Earth satellite preproposal will be designed and tested for U.S. Air Force by the Defense Research Agency.

Adrian Division of General Motors Corp. Work centers on a 7.4L 3000 diesel-cum-gasoline (AW) Jan. 22, p. 225 which can operate on almost any power source, including solar. Future work: provide power for satellite instruments.

Maneuvered buoyancy is a technique of self-inflating control surfaces for light testing on the North American N-15 rocket research aircraft, under a contract awarded by Wright Air Development Center. Problems in compressible flow around some surfaces is analogous to pure reaction control in space.

General Electric Co.'s Missile and Space Vehicle Dept. announced plans last week to build a \$14 million space technology research and development center near Valley Forge, Pa. Construction of the facility will be spread over the next four years and, under present plans, will be completely

tioned by the company. Initial construction, scheduled for completion in 1991, will include a headquarters building, an aerosol test laboratory, an engineering and development facility and manufacturing buildings.



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Carriers Open New Pacific Route Battle

Interest in Trans-Pacific Route Case spotlights area's potential as leading generator of traffic.

Honolulu-Battle for new air routes that spotlight the Pacific basin as one of the world's leading air traffic potential areas has opened here in the first round of the Civil Aeronautics Board's Trans-Pacific Route Case.

By the end of last week, 11 U. S. carriers had made their initial bids in public hearings here for a wide range of Pacific Ocean routes that stretch from mainland-Hawaii routes to Tokyo and Saipan, New Zealand and Australia, Tokyo and beyond to Bangkok, Saigon, Singapore and Dacca. Hearings began on Oct. 26 and are scheduled to be resumed tomorrow in San Francisco.

The case was prompted by an exchange of correspondence between the White House and the CAB chairman in which President Eisenhower instructed in part that U. S. flag service "must be developed as rapidly as it can be justified by the growth of U. S. Ocean traffic." He said "... in the Pacific ... little progress in the desired direction has been made" and added:

"I believe it essential to our foreign policy, and Administration objectives that the entire Pacific route complex be properly considered as a whole by the Civil Aeronautics Board."

Technique recorded during the hearings here at the Royal Hawaiian Hotel focused attention on the explosive traffic growth predicted for the future in the Pacific Ocean area. The Honolulu Chamber of Commerce forecast that the new state of Hawaii will receive 415,000 tourists in 1962 and have the 17,000 hotel rooms to accommodate them.

Another forecast, presented by the Hawaii Visitors Bureau, indicated that total visitors who stay in Hawaii 24 or longer will climb from an expected 240,000 in 1959 to more than 775,000 in 1965. Overall air traffic, including tourist passengers, jumped from 95,000 in 1951 to about 290,000 last year.

Foreign Competition

Trans-Pacific traffic is showing startling spectacular increases, although there are strong signs that U. S. carriers are losing a substantial share of these gains to foreign flag carriers, especially to Japan Air Lines which is now operating the same number of flights between Tokyo and the U. S. as other Northwest or Pan American.

Since foreign flag carriers do not report to the CAB the number of passengers using their services, it is not possible to determine total trans-Pacific traffic or the amount of participation in the market by foreign flag operators. However, this much is known: traffic cannot be both Northwest and Pan

American on the route, climbed from 3,000 passengers in September, 1953, to 7,100 in the same month of 1955. Yet this represents a drop from the 7,700 passengers both airlines carried in September, 1957—the year Japan Air Lines took its scheduled flight frequencies from five to six each day.

The hearings disclosed a new emphasis on low fares and the speed of jet flights as the two factors that will contribute to the successful development of the Pacific markets. Northwest already proposes new routes from San Francisco and Los Angeles to Honolulu and beyond to Tokyo, a route to offer an occasional class fare of \$399 between the West Coast and Tokyo for \$ 941. Pan American said it is prepared to place its current fare by "about 20% below present levels—the same that British Overseas Airways Corp. held out for its last month's International Air Transport Association conference held here Sept. 2, 1955. Pan Am also says it is seeking a great circle Seattle-Tokyo route, Chicago-Honolulu direct and a third route from Los Angeles to Tokyo, Saigon, Suva, Noumea, Auckland and Sydney.

Continental Airlines, which is making its first bid for a Pacific route from Chicago-Kansas City-Denver-Los Angeles and San Francisco direct to Honolulu, says it is ready to offer jet service between Chicago and Honolulu for \$141 with an 8 hr. nonstop jet

flight. Continental also noted that the current fare between San Francisco and Honolulu was \$123 with a DC-7 flight time of 8 hr. between those two points.

Western is proposing a first-class service with "equipped fares." Specifically, the airline wants to offer non-stop, nonstop flights from the West Coast gateways of Los Angeles, San Francisco and San Diego at \$99 to \$140 on the island of Hawaii and \$106-44 to Honolulu on Oahu. First-class fare to Honolulu will be \$110 with an "equipped" meal which will allow passengers to enjoy shipboard privileges at any air-conditioned island city, establishing joint fares with both of the two international airlines.

First-Class Only

Equipped fares are possible only in first-class operations since international carriers do not offer tourist services in the trans-Pacific service. According to Western, the equipped fares will be "sold out" as a private barge under which Western will absorb the larger part of the fare differential.

The South Pacific region, historically without any regular direct air service to the North American continent, is now the covered goal of four of the carriers in the case—Hawaii, Pan Am, American, South Pacific, Transoceanic and United States Overseas.

Hawaii Airlines, which began its inter-island service in 1925 with the Seawing, is a 18 flying boat, is seeking an especially strong case for the Tokyo route as the U. S. maintenance to compete with the French carrier TAI (see p. 10). Its big bid came during the hearings. Hawaiian Airlines President Arthur D. Lewis said that his carrier fight to Tokyo last year to decrease the island's tourist and economic potential had not met the company that Tokyo "will develop into a major tourist center" if it is not met with good air service and proper protection.

He added that once air service is available and hotel accommodations are provided "we believe that you will see one of the most phenomenal developments of tourism ever in the Pacific." He noted that "several of our directors had so strong about that that they are participating in hotel development in Hawaii" said that he has been assured "hotel facilities will be available in record time."

At present South Pacific Airlines is considered as a supplemental air carrier to operate Honolulu-Tokyo service but



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AMERICAN AIRLINES

The Jet Airline



Qantas Readies Lockheed Electras for Service

Qantas Empire Airways, the Australian airline, has scripted delivery of first two of four Lockheed Electra twin-engine transporters, its 79-passenger midsizejet (AW Aug 2, 1958, p. 51). Forward compartment can be converted into a cargo unit of 5,500 lb capacity. Sydney-Tokyo service study in December. Fitted as Model 160C extended-range version (AW Aug 31, p. 50) which bore a 116,000 lb gross weight, up 1,000 lb.

vented by budget considerations. The VC-117 VIP transport version of the 707 will be converted, Tulas believes. • Long-range 707-320 with Pratt & Whitney turbojets could be flying New York-Moscow route in 1961, according to Tulas. Russia's Tu-114 long-range transport will not be operational until the run before that year, the Boeing official predicted. To get the fast cargo into a 720 Tulas said, "we just need somebody to buy one."

• Breakers take point for the 707 line has not been reached. Boeing has no estimate of what that point would be. Orders for all commercial models now total 197.

• Leading edge modification of the 707-110 and 720 wings postpones compressibility to permit high Mach flight with the more powerful engines. But low-speed flight characteristics are not reduced, according to Boeing. The new leading edge runs from the wing root to the ribbed section. Leading rib tip modification involves extension of the center flap already on the 720 and addition of another flap inboard and a third outboard. Main modification also are being made to trailing edge flaps.

• KC-119 deliveries to the Air Force now total about 320 of 420 ordered. Production of the tankers is now seven a month. Commercial jets are selling out at a rate of eight a month which now will reach one. Boeing's third 707-320 (now 120 with 714 engines) is in final production stage. Bristol had ordered five 720s, of which one was lost as a pre-delivery training flight last month (AW Oct. 25, p. 45).

• Cost to an airline of converting a

1956 model 707 was set at about \$14 million by Tulas. He said this included all factors, such as time out of service. Two to three years of operation would be needed to make back the investment Tulas said, but the airplane should then be good for 15 years.

• Nine suppressors for 720 model without vibration engines have eight instead of 12 tubes, but do as good a job of quieting the engines, according to Boeing.

CAB Examiner Advises Rejection of TAN Bid

Washington—Transportes Aereos Nacionales S. A., of Honduras, was charged last week with cheating its foreign air carrier permit by a Civil Aeronautics Board hearing chairman who recommended that the Board reject the airline's request for a renewal of the permit.

Major portion of Boarder Richard A. Wicks' 62-page memorandum stated the irregular history of TAN's foreign air carrier permit, a series of alleged violations committed by the airline and an "overall" conclusion that the airline's longer air service are largely dependent upon the Board's going "enormously great lengths" to not create considerations.

The Boarder stated, Wicks said, does not qualify as "a willing and able" for renewal of its permit because of its excessive carriage of fifth freedom traffic between Miami and South America, which has continued despite CAB warnings. Quoted by TAN of two "paper companies" for the purpose of making its South American operations,

along with the airline's refusal to submit records to answer to a CAB request, Wicks added, indicates that TAN has "wittingly and knowingly flouted the law." Board member of the carrier's foreign air carrier permit, he said, would only encourage it to "greater revenues in its plan of transport of the U.S. South American market."

Originally authorized to operate between Miami and Honduras, the carrier gradually expanded its operations into Guatemala, Nicaragua, Brazil, Peru, Ecuador and Argentina, Wicks said. The expansion, he said, was carried out by means of "interline agreements" with Compañia Guatemalteca de Aviación, an Ecuadorian carrier, and Aerolineas Pinaros S. A., a Peruvian airline. The latter "paper company" is charged with denied by TAN when it became apparent the CAB was about to reject the airline's bid for increasing excessive fifth freedom traffic at an estimated \$1,000,000 annual diversion loss to American flag carriers operating between Miami and South America.

Wicks said TAN provided the two airlines with "extensive capital transactions, placed aircraft in their possession without cost and provided them with everything else needed in their operations." The arrangement, he added, was made "voluntarily" to "decide the Board into thinking that TAN was withdrawing from the Miami-South American market" while, actually, through the TAN-APSA-CGA coalition, it was making even deeper penetration into those markets for the purpose of diverting traffic legally authorized for carriage by a number of American flag and South American carriers.

Delta lubricates DC-8 jet fleet with Texaco



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Copilot Inattention, Autopilot Blamed in Uncontrolled 707 Dive

Washington—An uncontrolled 28,000-ft descent of a Pan American Boeing 707 over the Atlantic last Feb. 1 (AW Feb. 9, p. 39) resulted from copilot inattention after disengagement of the autopilot, the Civil Aeronautics Board said last week.

The Board said contributing factors to the accident, which occurred during the captain's absence from the cockpit, included the autopilot disengagement warning light in the five position and the Mach trim switch in the "off" position.

The flight was en route from Paris to New York with 119 passengers and 10 crew members aboard and flying in smooth air at 35,000 ft, with autopilot engaged when Capt. W. Waldo Lorch left the cockpit and entered the main cabin, the report said. During its absence, the autopilot disengaged for unknown reasons and the aircraft "smoothly and slowly" entered a steep descending spiral. The copilot, Samuel Polve, was not properly monitoring the aircraft's instruments on passage of the flight, the CAB said, and was unaware of the aircraft's actions until considerable altitude had been gained and altitude lost. He was then unable to make recoveries.

The first indications the copilot had that the flight was not proceeding normally came when he felt the aircraft buffet, the report said. That was made doubly followed by an indication that positive acceleration lines were lighting up rapidly. The buffeting increased as altitude and air instrument panel lights died out.

The report said the copilot then decided the engine's instrument panel which remained lit, saw that the artificial horizon had tumbled and consequently was of no use to him. He then glanced up and saw the stars moving rapidly counterclockwise, indicating that the aircraft was in a nose down right spiral and almost made to roll over on its back.

At this point, the report said, the

copilot pushed the control wheel, pulled the autopilot release button and attempted to recover by applying full aileron and rudder, but that by this time he was virtually immobilized physically by the pressure created during the maneuver.

When Capt. Lorch became aware of the unusual attitude of the aircraft, according to the report, he attempted to the cockpit with considerable difficulty because of the pressure streaming from the duct and took over command.

He first pulled the power levers to idle position and then pulled forward into his seat. A glance at the instruments showed the unspooled needle in the vacuum area to the right near the zero mark, and the altimeter pointing to 12,000 ft. The needle bearing a "torque" note.

Lorch testified that he could not see the Mach meter because it was hidden by the control wheel and that he could not tell his head. The artificial horizon was of no use since it had tumbled, and the turn and bank indicator was full to the right with the ball positioned slightly to the left of center. The altimeter was in the full nose down position, and his electric trim button failed to function. The aircraft was in a steep climb, and visual reference was impossible.

While navigator John Lohd managed to listen the captain's seat belt, Capt. Lorch relied on his instinct, relying on force. Flight engineer George Sayle was unable to move about and pulled the aircraft breaker, destroying the stabilizer trim and added both aileron trim tabs toward the up position by hand.

As the aircraft passed through the 8,000-ft level, the report said, Lorch pulled the take back with a sudden pull. At 6,000 ft, there was a sudden pounding as the aircraft entered a steep climb. The aircraft then seemed to descend and began a steep climb. At 4,000 ft, the wings were level and the aircraft was in a moderate climb and responding reasonably well to control demands.

Following the incident the Federal Aviation Agency, after failure to comply with Part 41.02 (Pilot in Control) of the Civil Air Regulations, levied a civil penalty against Lorch and suspended the copilot's Air Transport Rating for a six-month period.

Pave, who was eligible for reinstatement, subsequently left the company as pilot. In addition, Lorch and Pave were each fined \$1,000 each by the Airline Pilot

Association for returning to the cockpit and flying the 707's before the action and management had reached agreement on jet contracts.

Pan American also has issued a ruling specifically directing that one pilot give continuous attention to the attitude and flight of the aircraft during any autopilot disengagement. The ruling is based on its pilot training program, the narrow speed margins between the 707's normal and critical speeds and the brief interval of time required for the aircraft to accelerate into the critical speed ranges.

BOAC Shows Deficit Of \$14 Million for Year

London—Although British Overseas Airways Corp. posted an operating profit in the year ended Mar. 31, slight solvent on capital and operating losses by associated companies gave the BOAC group a deficit of more than \$14 million for that period. That added to previous year deficits, gave a cumulative deficit of \$38.2 million loss.

BOAC's own operations during the year yielded a total revenue of \$167.5 million, \$155.5 million, or 9.1% more than in 1977-78. Expenditure (excluding capital interest) took more than \$161 million (up \$13.7 million), which gave an operating profit of \$22.5 million, compared with a loss the previous year of nearly \$1 million.

Interest on capital rose by \$1 million to more than \$6 million, leaving a deficit of \$5.5 million, compared with one of more \$5.5 million for 1977-78.

Chairman Sir Gerald D'Elaguere said the airline would have had a better showing had the engineers' strike in Gatwick, 1978, cost about \$15 million, and an estimated \$1.5 million loss due to delay in passing passengers to fly across the Pacific as BOAC's round-the-world service.

Mounting losses by associated companies, of which there are 14, are causing BOAC some concern. Their combined operating losses for the year totaled more than \$7 million, compared with \$4.2 million the previous year. After paying interest on capital—\$1.3 million to \$1.57 million—the group up with a deficit of \$8.6 million, an increase of \$7 million.

These companies' losses are "dearly不可思议," Sir Gerald said and is in report, and BOAC now is making a civil penalty against Lorch and suspended the copilot's Air Transport Rating for a six-month period.

Commenting on the current fiscal year, the chairman said there should be a "substantial" improvement, and even after payment of interest, the airline could make a break-even result.

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BOEING 707 and 720



Dutch Flying School Operates Safir 91Ds

First five of 35 Sub-Safir 91D four place trainers no delivered to Dutch Government Civil Flying School (NIV 47, p. 59). School eventually will use only Sub 91Ds and North Model 116, of which it now has 12. In training other pilots mostly for KLM Royal Dutch Airlines. Safir 91D costs about \$20,000 and is powered by a Licensing O-360 A1A horizontally opposed piston engine.

Free Inter-Airport Transport Protested as Illegal by United

Washington—Volunteer provision of free ground transportation between airport terminals by 10 major airlines was attacked as illegal last week by United Air Lines.

In a complaint filed with the Civil Aeronautics Board contending that air line payments for such services result in an unfair rebate of a portion of an fare in violation of Section 405(b) of the Federal Aviation Act, United asked the Board for a cease and desist order against Capital, National, Braniff, Northwest, West Coast, Eastern, North-east, Continental, Trans World and American airlines.

But for the United filing started earlier than two years ago when the air line began to file exceptions to CAB economic regulations in order to provide free ground transportation for connecting passengers at specific airports to coincide with terminal operation changes according to Board spokesman. Most of the exceptions were filed this year, reflecting the greater use of aircraft which can only operate from certain fields because of runway lengths.

Although provision for the free transportation is a matter of record at the Board, its existence is little publicized, and spokesman for the carrier which offer the service point out that it is not automatically granted but must be requested by the passenger. Wording of the exception states that carrier "in respect to the passenger" will provide the transportation "with an independent customer" between certain designated airports, primarily in the area of New

York, Chicago, Detroit and Seattle. United told the Board.

Since CAB economic regulations require the airlines to act in the passenger's agent in selecting, United contended that offering free ground transportation is the 10 carriers is a violation of the section of the Federal Aviation Act that states that no carrier shall "directly or indirectly, or through an agent or broker," rebate or act in favor of a portion of an air fare or charge. Airline offering the ground transportation should therefore be ordered to comply with this section and note to provide the service, United said.

Actual volume of connecting passengers making discussion of the free ground transportation is small, according to an estimate by the Carter Transportation Co., which operates a fleet of airport limousines in the New York area.

Less than 5% of the connecting passengers between New York International and LaGuardia airports took advantage of the service last year according to Carter officials.

Exceptions to provide the free service between airline terminals came filed to cover the following carrier and area:

- Capital and National between New York International and LaGuardia airports.
- Braniff and Northwest between airports of the New York area terminals, including Newark.
- Capital and Eastern between airports of New York area terminals plus connect-

ing flights to Bermuda, San Juan, Puerto Rico and Mexico City and transatlantic flights departing out more than an hour after passenger arrival.

- Northeast between Idlewild and La Guardia for passengers connecting with other Northeast flights or flights of other airlines where Northeast is not used between New York and Florida.
- Northwest and West Coast at Seattle between the Seattle Tacoma Airport and Boeing Field for passengers connecting with flights of the two airlines.
- Northwest at Detroit between Willow Run and Detroit metropolitan airports.
- American at Chicago between Midway and O'Hare airports for connecting passengers bound for Chicago.
- Continental at Chicago between Midway and O'Hare.
- Trans World at Chicago between Midway and O'Hare and the West Coast. Ground transportation also is provided for the transfer between Idlewild and LaGuardia in New York for TWA connecting passengers flying to Chicago, St. Louis and west on its transatlantic flights.

Canadian Pacific Orders Four DC-8s

Vancouver, B. C.—Four Douglas DC-8 turboprop transports have been ordered by Canadian Pacific Airports, with options made to purchase another five aircraft, according to G. W. G. McCoskie, president.

Orders will be placed by first half 1969. The 15 turboprops, producing 18,900 b. thrust each. The airline said the DC-8s will cut Pacific West coast flying time to 8 h. Configuration will be for 139 passengers. Delivery is set for early in 1969.

TAI Route to Give France Global Service

By L.L. Doty

Tokyo—Transportes Aereos Intercontinentales, TAI, will inaugurate its newly awarded Tahiti-Honolulu-Los Angeles route in May and provide France with the final link it needs to begin its first transpacific air service.

C. Fisset, TAI administrator and general manager, told Aviation Week during the International Air Transport Association meeting here that this service to the new route will begin with a twice weekly round trip between Bora-Bora, Noumea, Tahiti and Los Angeles with Douglas DC-7s. Flown and frequency will be expanded in July, 1961, when the carrier introduces its two DC-8 freight transports on the route.

The new route, granted to TAI last August under terms of a revised bilateral pact between the U.S. and France, is another example of the growing importance of the Pacific basin in international aviation, indicating it is stronger than global air routes. Operators here feel that the route owed to France, as one of the first of recent Pacific route adjustments which most international airlines feel will be necessary to gain comparatively strong long-haul jet transports are introduced into service.

Final decisions in the Civil Aeronautics Board Transpacific case will determine which U.S. carrier will operate over the new southern Pacific route in competition with TAI. Under the terms of the revised bilateral agreement with France, the U.S. can operate routes from the West Coast via Honolulu to Tahiti, Bora Bora in the Society Islands, New Caledonia and beyond to ports in New Zealand and Australia.

At the present time, South Pacific Air Lines, a dominant international carrier, is authorized to operate the Hawaii-Tahiti route.

Competitive Areas

As important as it already is to domestic carrier hopes to expand overseas, the Transpacific case is viewed here as but one facet of an international route development race that will make the Pacific Ocean one of the hottest competitive areas in the world.

Most transpacific routes will be opened up to bilateral agreements between the countries involved which can create some thorn problems. France, for example, announced its bilateral with the U.S. last year because of its failure to win a U.S. jet permit under existing terms. A new agreement was signed in August after

it was renewed in Paris July 20 and France won all jet permits and the southern Pacific link with the U.S. West Coast.

At present, France is alone with its transpacific route on a bilateral with Australia because of its ability to win traffic rights at either Melbourne or Sydney, Australia's two largest cities. TAI is currently serving Brisbane and Darwin under a provisional agreement with Australia but, unless it is granted Sydney or Melbourne rights, all traffic to and from Australia will be handled by Air France.

TAI's interest in the two cities stems from a strong confidence in the future of the Australian tourist market. The carrier is encouraging the development of tourist facilities in Noumea, including a casino, as a first step toward creating a tourist attraction that will generate a large volume of traffic from Australia to the Pacific island.

Hopes for Tahiti

The airline is also losing the groundswell for similar tourist facilities in Tahiti so that accommodations will be available in sufficient number to handle the traffic it expects to generate in the U.S. The carrier is encouraging the construction of hotel facilities in the southernmost areas of the islands as the most comfortable way to eliminate, for tourists.

But its new route was to construct a runway 32,300 ft. in length on the land point just surrounding the shore line of Tahiti. Since the tide at Tahiti averages no more than six inches, the project does not pose any major engineering problems. At least one company is building the runway, in Hong Kong harbor at Kai Tak Airport (AW 15 p. 41).

Just 5,000 ft. of the runway will be completed next year when TAI

begins its DC-7 service, and the balance will be completed in time for the mid-1960s.

In effect, TAI is about to tap two new tourist markets previously unavailable to the U.S. and Australia—and, at the same time, is developing two previously untouched tourist areas—Noumea and Tahiti.

TAI will have no response on the route from the U.S. No less than five of the nine U.S. carriers petitioning the CAA for Pacific routes are seeking traffic rights to Tahiti and if it develops a route to handle traffic in the southern Pacific islands is successful, other carriers will strive to gain entry into the area for their flag carriers.

The French bilateral agreement provides that a polar route from the West Coast to Paris may be operated from either San Francisco or Los Angeles and that the route from Honolulu and Tahiti may serve either one of the two cities. Both Air France and TAI agreed that a French carrier could be the most desirable connecting point rather than San Francisco for the French around the world service and at the last potential market area for developing traffic to both France and the South Pacific area.

Traffic Split

Gen. Fleet told Aviation Week that his company has cooperated closely with Air France in the selection of routes to and from the bilateral with the U.S. Although Air France has been offered a strengthened national flag carrier of France, the government has acknowledged officials both TAI and Air France are aware of the Transpacific, UAT, and Air France's transport routes in Africa and the Pacific basin. TAI and UAT are independently owned airlines. Air France is a state-owned carrier.

TAI, which operates routes into West Africa, has available shared jet traffic on the Paris-Tai route on a 50-50 basis with Air France under the terms of the 1955 Paris-Geneva agreements. UAT, which operates to West Coast, Central and South America, has been in open conflict with Air France during the past few years over the release position of the two carriers on the African routes.

Air France has argued that it has major experience in Africa and has a broad background of airline traffic. African airlines in technical assistance programs UAT claims that it is more desirable to have a privately owned carrier rather than a national organization. UAT's technical assistance since its origin of French colonization is thus increased.

On the other hand, cooperation be-

tween Air France and TAI has been close. The new, around the world route is expected to strengthen both carriers' subsidiaries. Air France already has expanded connections with the Los Angeles-Montréal-Paris polar route and added that, last year, had factors as the transpacific route, without the benefits of a polar route, which 85%. Air France carried 2.5 million passengers in 1958 at an average distance of 800 mi.

TAI expects to benefit from its new transpacific route since, according to Fisset, the carrier understands the Pacific Ocean area to hold the largest traffic potential of any worldwide long-haul area in the world. TAI's route, until the bilateral agreement with the U.S. is signed, terminated at Bora Bora and the carriers must be satisfied that Air France. Now, the South Pacific route which begins at Phoenix Port and Suva, continues through to Doha and Bahrain to Los Angeles via Noumea, Nadi and Auckland and Seattle's Queen's Island—Tahiti and Honolulu.

Meanwhile, both Air France and TAI recognize increased competition can be expected as the Pacific basin grows in importance. More polar routes will be seen, new routes will be sought by business attraction and concern, changes continued in all bilateral will be noticeable. There will be renewed negotiations over the international legal interpretation of cabotage which, for example, forces French Air Lines to operate on main oceans with low load factors while the U.S. mainland and Hawaii while U.S. carriers are operating at capacity loads overhauled into new routes. The U.S. will be the first to see the need for the new routes.

And finally, the growing possibility of an open route on Pacific routes (AW Nov. 2, p. 38) coupled with the fact of restrictions on starting competition will serve only to intensify the continuing battle for Pacific traffic.

Boost in Earnings Reported by United

Change-United Air Lines last week announced net earnings of \$12.7 million, a gain of 60% over net profit of \$7.9 million in the first nine months of 1959.

Total net earnings for the same period of last year totaled \$10.5 million. Revenues reached a new high for the company during the 1959 nine-month period totaling \$277.9 million—a 9% increase over 1958.

Operating expenses for the period were \$288.7 million compared with \$279.9 million for the nine months ended Sept. 30, 1958. Total revenue passenger miles totaled 4 billion, a 4% increase over the same nine-month period of 1958. Freight ton miles climbed 21% and mail ton miles 10%.



The Spoken Word—Part III

The current state of the art of air traffic control cannot be better illustrated than by various prevailing conditions at some of our busy terminals. Thus phase of traffic control today is almost exclusively a function of voice communication so it is not without reason that our reports can be reported as "haphazard, hounding on post."

An example of good control can be found at LaGuardia Field where a pilot's request for low clearance established his altitude figures (navigating VFR conditions). By adhering to this principle of "first come first served" the LGA tower clears pilots more plane calls over pilots than they will be taken care of in ten.

Quick the separate effect it obtained at Washington National during VFR conditions. No semblance of progress is mentioned here. The No. 4 aircraft is late into call box, and receive, takeoff clearance before anyone else. Pilots at Washington know that carriers don't get into a state that get your "read" message to the tower, plus an answering acknowledgment on your own account "all final Charles" Read? Pilot kept asking for cleared clearance read at once. This was being broken up after contacts, it read, even that just aircraft are holding at once. It certainly means that impasse can tunnel from the constant heterodyning. But at Washington this is what you must do.

'Alphabets and Gustos'

Washington uses the "Alphabets and Gustos" method. That is, a typical conversation can go like this: "United, do you see TWA?" (pause for answer). Then, "TWA, do you see United?" (pause for answer). Then, "OK, United, do you have the Viscount over the runway?" (answer). "Can you follow me, United?" (answer). "OK, now American, do you see Gusto over the runway?" (answer). And so on—plus, plus—no control, and in this time the time both which has been unable to get a word in edgewise, even the field and all segments must be revised.

LaGuardia, on the other hand, uses the positive control method. In the same situation the controller might say, "TWA, have you a United DC-8 south of the tower, follow that aircraft via me No. 5 in hand." Then the LGA controller had assumed several things, that pilots are big boys, that if TWA can't find United he will say so and that the TWA captain must know positions sufficient to know how to follow another aircraft. Explicit here, this is accomplished the noise doesn't care.

That is the Comm's problem, not the controller's. One reason for some of these deficiencies is that there is no real scheduling for tower controllers. On the way, they read some regulations and get a license. But unless some kind of chief tests it upon license, there is no training in the fact, subtleties and psychology of control—and don't think, for one minute that there are not needed. But this should be learned in the technical—not during the approach of a Boeing 707. As it stands now, our airports are complete and are a "mess."

Good towers and good chiefs—but downtown, don't, unless are better. And these should need backing from Federal Aviation Agency operators people and preference from those who are critical with their insistence that every word, route and thought be spoken verbatim in an effort to prevent against all possibilities.

Traffic control at a major terminal is a major occupation and requires professionals. It must operate in a firm, calm and intelligent manner. It must appreciate the principle of first come first served. Unless we have good men on the job, our fast appearing jets will induce airport snafus to happen infrequently.

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FOUR"

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THERE ARE NO IF'S, ANDS OR BUTS ABOUT THE CANADAIR FORTY FOUR. It is a "here and now" swing-tail cargo plane, at least 18 months ahead of comparable aircraft still in the "talking stage." The turbo-prop "Forty Four" is in full production for two leading American airlines and the military services of Canada. It has already been through the development stage and its Rolls-Royce Tyne engines have been thoroughly tested and proved. With the "Forty Four" in your fleet, you can be 18 months ahead of competition and in a most favorable earning position.



First photographs of the Canadair Forty Four taken September 30, 1959 in Montreal. The "Forty Four" is now on the line for Seaboard and Western Airlines Inc., The Flying Tiger Lines and the Royal Canadian Air Force.

CANADAIR LIMITED MONTREAL CANADIAN SUBSIDIARY OF
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AIRLINE OBSERVER

► Arab countries after dropping plans to merge all Arabian airlines into a supranational airline (AW Oct. 26, p. 49), now plan to create a new airline owned and operated by existing airlines and their governments. New, even without international routes to Africa and the Far East but will not replace existing airlines which will continue to serve their regional and national schedules. To be known as the United Arab Airline, the company will be capitalized with an initial \$48 million and will operate an all-turboprop fleet. It is Lebanese-inspired and has not drawn strong support from the United Arab Republic. Clashes of headquarters and percentage of capital participation by Arab League member states are expected to be major hurdles for the carrier of the united cause.

► Qantas Empire Airways has disposed of 30 of its piston-engine aircraft in the U. S. Six Lockheed 1849 Constellation have gone to Lockheed as trainers in the airline's Lockheed Electric order (see p. 49). Two Constellations were placed with Boeing at trade-in for Boeing 707 turboprops. Two DC-4s have been sold to a U. S. supplemental carrier. Carrier dropped air plan to convert the aircraft to cargo planes on grounds that cargo traffic to and from Australia would not justify such a fleet.

► Jet noise problems in becoming a major issue in Germany. Hoesberg has authorized Pan American to begin Boeing 707 flights to and from the city but has placed stringent noise abatement restrictions on night flights. Other German cities are offering stiff resistance to jet flights under any operating conditions or restrictions.

► Aeroflot, Soviet state-owned airline which on several occasions has denounced International Air Transport Assn. fare standards as too high, has slashed its jet tariffs by as to 25% on its twin-Sukhoi run for the winter season. Effective Nov. 1 through May 15, the Moscow-Kishinev-Tbilisi fare will be cut from \$490 to \$350 miles. At the 10 rubles-per-dollar tourist rate of exchange, the new fare for the 4,250-mile trip comes to only 2.5 cents per mile. At the official four rubles per dollar rate of exchange, the tariff is seven cents per mile. Other winter fare reductions include Moscow-Istanbul from 1,050 to 790 rubles, Moscow-Novosibirsk from 745 to 568 rubles, Moscow-Charkov from 610 to 468 rubles and Moscow-Sverdlovsk from 570 to 385 rubles.

► M&M, Hongkong state airline, plans to purchase a fleet of three Russian-built Il 15 turboprop transports in 1968 to operate new routes it plans to inaugurate from Bangkok to the Middle and Near East.

► Northwest Airlines has proposed an economy plus fare of \$595 between U. S. West Coast cities and Tokyo and \$495 between New York and Tokyo. Proposals were contained in exhibits offered in the Civil Aeronautics Board Trans-Pacific Route Case. Meanwhile, Japan Air Lines has proposed a jet embargo on Coast-to-coast Boeing 707s operated by British Overseas Airways Corp. and Pan American respectively between Hong Kong and Tokyo.

► Air India International last week received its foreign air carrier permit signed by President Eisenhower to operate the route between New York and India via intermediate points of Belgium, Luxembourg, Rome, Cairo, Rome, Zurich, Prague, Geneva, Paris, Düsseldorf, London, Shannon, Keflavik and Montreal. Last month, J. R. D. Tata, chairman of Air India, told Air Transport World that the transatlantic service probably would not be implemented until the spring of 1961 (AW Oct. 26, p. 49).

► Anna, of Local Transport Airlines will undertake research and study of plans designed to increase efficiency of operations through new regulatory approach and industry innovations. Six research institutions will present bids for the project at forthcoming quarterly regional meeting that work in Indianapolis.

► Trans World Airlines, which is now experiencing a 50/50 traffic ratio between tourist and economy class passengers on its North Atlantic route, expects the ratio to change to 80/20 economy and 20/80 tourist within the next year.

SHORTLINES


► Bonanza Air Lines is now operating a daily round trip service on its tugboat between Los Angeles and Phoenix via Riverside, Palm Springs and Hittite, Calif. Weekround trip departs Phoenix at 8:45 p. m. and arrives Los Angeles at 5:54 p. m. Roundabout service departs Los Angeles at 6:50 p. m. and arrives at Phoenix at 8:54 p. m. All times are local.

► National Airlines has resumed Boeing 707 nonstop service between New York and Miami, offering both first class and coach accommodations. The carrier is scheduling four round trip flights with northbound flights departing New York International Airport at 9:35 a. m., 1:15, 5:35 and 9:15 p. m. Northbound flights depart Miami International Airport at 9:35 a. m., 1:25, 5:35 and 10:00 p. m. National also is operating a daily round trip service between New York and Fort Lauderdale with Douglas DC-6Bs and will begin Philadelphia-Washington-Fort Lauderdale service with Lockheed Electra turboprops on Dec. 1.

► National Fire Protection Assn. reports U. S. aircraft fires cost \$143 and lost in property losses in 1958, an increase of \$28 million over the 1957 total. The number of aircraft damaged or destroyed by fire, however, declined from 203 in 1957 to 175 in 1958, the association estimate showed.

► Trans-Texas Airways reports to estimate of 15,531 passengers boarded in the first nine months of 1959 over the same period of 1958 on the carrier routes for a total of 209,159. Revenue passenger miles for the period increased by 26% to 49,237,002 for a load factor of 44.1%, up 6.4%.

► Trans World Airlines recorded substantial increases in both traffic and financial figures for the first nine months of the year. The airline has a total of 4,397,000 revenue passenger miles during the period and earned a total revenue of \$204,196,000. Net profit after taxes for the period was \$9,068,000 or \$1.16 per share on \$474,115 shares of stock outstanding. In 1958, TWA had a net revenue of \$131,680,000. Third quarter 1959 revenue was \$104,333,000 with a net profit after taxes of \$7,504,000. In September, TWA earned 920,911 passengers, up 21%, from 753 million revenue passenger miles, up 11.5% from 667 million in the same month of 1958, with TWA's Boeing 707 turbojet load factor remaining at 90% since the start of jet service on its routes.



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LOCKHEED



SOLID STREAM of light is the appearance of the heatback wave which travels down the Boeing shock tube. At right is the condenser bank and see chamber, while at left end of tube is the brass target upon which the wave impinges. Speed is about Mach 250.

Boeing Groups Probe Space Techniques

By Richard Sweeney



PLASMA phenomenon is examined by Edward Sells, of Boeing Scientific Research Laboratory. His test is used for basic research in conversion of heat to electrical energy.

Seattle—Probing to discover the phenomena involved in plasma ion energy through electromagnetic radiation, scientists at Boeing Scientific Research Laboratory, here are investigating basic unknowns of this and other advanced fields of space technology.

BSRL is one of two entities under the direction of George Schuster, Boeing vice president-research and development. The other is Product Research, which looks for new areas where Boeing can sell hardware, ideas or services at a later date. It supports all company developments for military, nuclear, aerospace and research of BSRL activities. Ben F. Radtke heads the Product Research Office while Geoffrey Hollingsworth leads the BSRL. Hollingsworth also heads a subunit of BSRL—Geometric physics Laboratory.

Five Groups

There are five groups under BSRL, classified according to their interests. They are:

- **Mathematics Laboratory**, headed by Dr. Barton H. Cohen, which seeks to develop better mathematical expressions of and solutions to various problems in a number of fields.
- **Solid State Laboratory**, headed by Dr. Hans Bethe, which works on the mechanical, physical and electrical properties of materials at a very fundamental level.

- **Geophysics Laboratory**, headed by Geoffrey Hollingsworth, which works in determination of the various properties and characteristics of space.
- **Plasma Physics Laboratory**, headed by Dr. James Duvvillard, which works in various basic characteristics of plasmas and their use.
- **Tight Sciences Laboratory**, headed by Dr. Yusef A. Yusef, which works in several areas involved in aerodynamics and space flight regimes.

Academic Freedom

Work in BSRL is carried on in a free atmosphere. It is also in a strictly company, headed in reasonable and constant level. These factors add considerably to their efforts, scientists feel, since they are not working to achieve specific goals set by someone but themselves. They outline what they want to do, and what they may find. If findings are not as expected, this is accepted; they may be on the track of something totally new and unexpected. Once their project starts they do not have to constantly push its continuation nor to meet specific reporting dates with specific results. If the work looks like a blind alley, they are the ones who will cancel the project and start an other.

Currently housed in the engineering building of the main Seattle plant, BSRL will move into its own building in the future—a building designed to its peculiar requirements on the inside and without a focus on the outside. All laboratory work will be of an endless-foot nature.

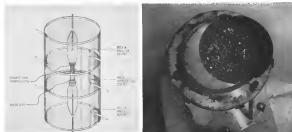
Work of the Plasma Physics Laboratory presents an excellent illustration of the basic research concept as practiced



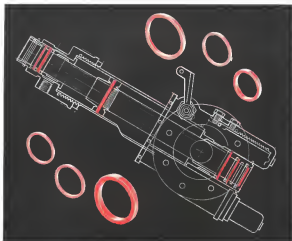
CONDENSER bank, which throws 25,000 v., into the shock tube chamber, is adjusted by a Boeing technician. The BSRL tube is a tool to achieve high temperatures.



TECHNICIAN pumps liquid nitrogen into the target end of the shock tube.



ENERGY conversion tube with temperature control jacket is at left. Note positioning of conical thermocouple and made lead in the plasma thermocouple unit. At right is a lens target which shows dimpling and other defects after being struck by a heat-shock wave; tube temperature is at the 100,000°C range. Face of the brass target shows a made of spots.



Redesign with TFE resins puts faster punch in hydraulic system

A change to piston, back-up and wiper rings of Timon TFE-fluorocarbon resin made a big difference in the speed of response to controls in the Lockheed 3040 Super Constellation. So greatly did these rings reduce friction, wear and oil leakage that, besides this experience, similar sets of DuPont TFE resin were designed into Lockheed's new Project Electra.

Back-up rings of Timon TFE-fluorocarbon resin are far superior to conventional leather rings in deformation characteristics, wearability, transparency and frictional properties. PTFE-lined wiper rings give added protection against system contamination by dust, water, paint and cleaners.

Piston sealing rings of TFE resin, which need no high-pressure build-up for sealing, reduce oil leakage without increasing friction or piston wear.

The coefficient of friction of Timon TFE-fluorocarbon resin is so low that they require no lubrication. They can be used at cylinder temperatures up to 300°F and are unaffected by even the most corrosive synthetic hydraulic fluids. Your local supplier listed in the Yellow Pages under "Plastics—Du Pont" can give you additional data. Or write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept., Room T-7119, Du Pont Building, Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P.O. Box 660, Montreal.



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Timon is Du Pont's registered trademark for its fluorocarbon resin, including the TFE (tetrafluoroethylene) resin described herein.

BETTER THINGS FOR BETTER THINGS — DuPont Chemicals

at Boeing Scientific Research Laboratories

- The effort is in four areas:
- Plasma induction research in the area of plasma oscillations
- Plasma oscillations records
- Plasma diagnostics
- Plasma diffusion studies

There is a theoretical group in the laboratory which now is studying radiation and absorption of microwave by inhomogeneous plasmas. This is purely a theoretical exercise, to try to analyze what happens and how and when in the phenomena.

In induction research in the area of plasma oscillations, the Boeing shock tube will be used. Guns will be set up 180 deg. across from each other and will shoot electron beams at each other through the plasma to set up a plane of oscillation within the plasma. They will then create a pressure gradient that moves down the tube and see if the oscillations will induce microwave when the wave passes through the plane of oscillation.

To establish the wave, a wall of metal or some material will move in at one end of the tube to compress the plasma, create the gradient and send it down the tube. This gradient should create microwave radiation at the plane of the oscillation. For this work, the pressure gradient is creating an inhomogeneous plasma, although in the worst sense of the word, the mixture of ion, electron and neutral atoms which form a plasma are inhomogeneous by their nature.

This will test the basic theory of inhomogeneous plasma condition of microwave at the oscillation plane. Radiation frequency spectrum varies according to the type of plasma—in ion plasma induces in the radio frequency spectrum while electron plasma induces in the microwave frequency spectrum.

There is, in reality, an "electron gas" which essentially is electron moving about, which has been experimentally demonstrated. In semiconductor, it has been proposed to use this electron movement of oscillation as a source of microwave length resonator and control device.

Results of the plasma radiation research in the plane of oscillation will become the basis for the second effort, that of plasma oscillation research. If the postulations of the first work are not true (the dual electron beam does not produce oscillation which exists in the plasma when gradient moves through), then the researchers will return to the standard technique of shooting an electron beam across the plasma and have it become back. This is definitely known to produce the desired oscillation.

The latest thing is to shut down the electron beam in a few millisecond-



FUNCTIONALLY-DESIGNED building costing about \$15 million will house Boeing 3400-tile Research Laboratories here. Building's main floor will have 24 laboratories.

crisis, (10%), and watch the rate of oscillation decay. There are many methods available which are capable of shutting the beam off in this order of time.

Watching the rate of oscillation decay will tend to prove or disprove theoretical calculations of the cross section for microwave transfer. Such predictions exist for hydrogen gas plasma, but not for oxygen or nitrogen.

If the oscillations cannot be established in oxygen and nitrogen plasmas, or if the calculations of the cross section for microwave transfer for these two cannot be accomplished, then they will simply measure the oscillation and other parameters in the oxygen and nitrogen.

It, during the experiment, a family of curves develops relating collision frequency to temperature. Boeing scientists say, it might suggest a theoretical approach to calculation of the cross section for microwave transfer of the two gases.

The third phase of work in plasma physics will be plasma diagnosis, where measurement will occur in some more than the temperature and pressure of electron gas in a thermodynamic reactor.

There is a theory in this which was originally developed by the laboratory staff, Dr. Dorman. This says that if one establishes a homogeneous magnetic field throughout a homogeneous plasma and sends a right-hand polarized microwave signal along the field of such plasma, the cutoff frequency between transmission and absorption is a very sensitive function of temperature over several orders of magnitude.

Some of the predicted results of this theory have been found already, but the Boeing work will attempt to go further.

This theory essentially yields a "thermometer" for thermodynamic plasma temperature, and a basis to the kinematics of plasma theory. What it means is that a plasma at a certain temperature will pass microwave signals of a certain frequency, that is, it will be transparent to them. If the temperature changes, the plasma no longer will pass this frequency, but becomes opaque to and passes another frequency.

So if various frequency signals are sent through the plasma, only the right one for the present temperature of the plasma at that instant will pass through—only others will be cut. Therefore, the plasma temperature is fixed.

The range of temperatures involved is 10° to 100°K.

Fourth effort in the plasma physics work is plasma diffusion studies. There are some questions which will be of certain importance which have shown up between measured and predicted plasma diffusion rates across magnetic fields.

A part of the investigation will be attempts to determine how plasma enables the pressure gradient theory in the sun and in thermodynamic reactions.

In the case of the thermodynamic reactor, the plasma gets not despite the magnetic field if a theory can be found to predict where the change occurs, at what values of current or plasma density or temperature, in short when, why and how, and if the concept follows the path a theoretical should, this would



COMPUTER RESEARCH



COMPUTER RESEARCH: Though computers cannot yet approach the memory capacity and versatility of the human brain as an information processing device, Lockheed research scientists are engaged in building artificial neurons patterned closely after those of the brain. Neurons are connected in large networks and their behavior pattern observed. Information observed through this research is being used in the solution of elementary problems in learning and pattern recognition. Progress in this field is symbolized by the abacus — earliest form of computer.

EXPANDING THE FRONTIERS OF SPACE TECHNOLOGY

Lockheed's activities in the missile field began before World War II when the company designed and flew a piloted aircraft for the Army Air Corps. Today the Missiles and Space Division embraces every facet of research and development, engineering, test, and manufacture. It has complete capability in more than 40 areas of science and technology, from concept to operation.

The Division's advanced research and development programs now under intensive study provide a continuing challenge to creative engineering. These programs include: man in space, space communications, electronics, kinetic, nuclear and solar propulsion, magnetohydrodynamics, oceanography, computer research and development, operations research and analysis, human engineering, electromagnetic wave propagation and calibration, materials and processes and others.

Such programs reach far into the future and deal with unknown environments. It is a rewarding future which scientists and engineers of outstanding talent and ingenuity must be invited to share. Write: Research and Development Staff, Dept. K-17, 962 W. El Camino Real, Sunnyvale, California. U.S. citizenship required.

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924 Charter Street, Redwood City, California



indicates ways to solve problems in thermodynamic reactions.

Within Flight Sciences Laboratory, there are several fields of work, including energy conversion, propulsion, gas physics, aerodynamics and fluid mechanics.

Work of the gas physics association makes use of the shock tube, so does the Plasma Physics Laboratory, but with different goals.

The gas physics effort within Flight Sciences is the study of the phenomena involved in plasma low-energy, through electromagnetic radiation.

The tube and bank of electrodes which shoot 20,000 v. into the plasma are tools to obtain the high temperatures desired, coming at 1×10^6 deg. Kelvin. This are heating simple gases from 6,000 to 160,000K, in some cases up to approximately 500,000K.

Researchers would like to know, be what means so much energy is injected to the gas, and knowing how much has to come out in comparison with what actually does come out, they feel the unknown losses are about the difference is disappearing. They are able to measure heat transfer to walls of the shock tube, they can measure what comes out in kinetic energy, but there still is a large amount of energy unaccounted for.

Ultraviolet Spectrum

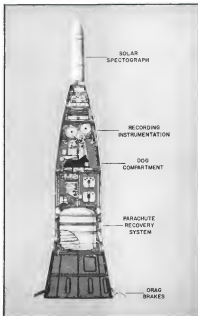
Currently they feel that much of the electromagnetic radiation is missing in the far ultraviolet spectrum, in the range between 10 and 2,000 angstrom units. To check this out, they are going to use a vacuum ultraviolet spectrograph which is on order and will be delivered soon.

In addition, they contemplate using a visible light spectrograph, which operates in the range of 2,000 to 30,000 angstrom units.

Much hope is held for establishing that the lost energy is accounting in the far ultraviolet spectrum through use of the vacuum ultraviolet spectrograph. The vacuum spectrograph has to be used since air will absorb electromagnetic radiation of wave lengths below 2,000 angstrom units so greatly as to completely eliminate it, therefore the work must operate in an ultra vacuum.

The spectrograph can operate with the tube trace the mean free path of the hydrogen molecules which are in the form of 0.1 millimeter, is greater than the size of the slit which is 10 microns. Therefore they cannot pass from the tube into the spectrograph.

Visible light, in the 2,000 to 30,000 angstrom units spectrum, is the section which produces the greatest amount of light radiation pressure, usually called photon energy. The gas physics investigation would like to turn about the



Soviet A-2 Research Vehicle Detailed

Extensive investigation of the forward portion of Soviet Russia's A-2 research vehicle nose section and its associated experiments with drag is shown in cutting drawing. Solar spectrograph is mounted in nose-chamber space at top. The dog compartment is sealed and pressurized. Additional instrumentation is below the dog's cabin. The ribbed container is the next bay down holds the parachute recovery system. The flood injection system at the bottom cross drag bucket. This vehicle is used for research experiments up to altitudes of about 150 mi. The Russian's A-3 research vehicle is used for experiments at altitudes approaching 300 mi, the lower level of the A-3 approximates that of the A-2. Both vehicles are equipped second stages launched by a thrust unit attached at the base of the flood section. Russian scientists have fired two dogs to an altitude of 279.61 mi in a single stage research rocket carrying a payload that weighed 3,726.45 lb., which is greater than the weight of Sputnik 1B. The dogs were recovered safely, the Soviets reported (SAW Nov. 3, 1960, p. 62). Rockets used in flights up to 732 mi. utilize an ascending speed of 1,66 mi. per sec.



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TEXAS



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APPARATUS DIVISION

methanol which releases the electro-magnetic radiation.

In the best case or, about, wave which travels down the tube after the electrical discharge, electrons with energy equal to 10 eV are converted into electromagnetic radiation. At wavelengths as long as the film layer, in order to understand the mechanism which involves using this principle for their advantage.

Illustrative of the concept in photonics is a black cloth was hung over the tube before the shot. As the wave passed the cloth moved slowly. This was to ensure the black cloth light that was a thin layer of air between the cloth and the tube wall, and they are now heated so rapidly because of the wave that the evaporated hot energy was disrupted by the cloth moving around. The heat was generated by the electromagnetic radiation (photon pressure), which was exact in the speed of the black wave.

The same effect can be observed in various point out, in the firing of a 72 caliber slug against a heavy steel plate. If one picks up the slug immediately, it is hot, the escape of its velocity having been transferred into heat when it stopped as suddenly.

Atmospheric Density

In operation, the burning trend is pushed down to 10 times of the pressure, at 0.1 atmospheres. As the conditions reach their full charge, a quantity of hydrogen is released into the tube from the end opposite to the air chamber. The gas then travels through the tube to 40 inches, and the gas diffuses throughout the tube rapidly.

When the gas reaches the air chamber, it begins the discharge wave it was at at a high, high enough to become an electrical conductor. All the stored energy of the conditions appears in the air chamber except for minor losses. All the other end of the tube is kept tight to seal for the wave to return again.

Since the radiation camp is known in the time travel down the tube, the radiation also seems to determine if it comes, as whether perhaps it is there or not. They do not know the pattern of radiation distribution that is whether it is higher or top of the tube or on the bottom or on one side or the other, and if it is higher in one certain place again, also.

They do not yet know of any relationship between the existing radiation energy and a magnetic field about the section. They intend to put a magnetic field around the section, building up gradually in strength and investigate the results.

Another interesting important field of work at BRL, Flight Sciences Laboratory is energy conversion. It is a known

fact that space is full of energy—that is needed are ways of converting the energy to useful work or power.

There are three main ways to convert at the present time, including:

- Solid state semiconductor such as solar batteries.
- Chemical reactions such as fuel cells.
- Classical conversion such as thermionic diodes or plasma thermocouples.

Solar batteries have one disadvantage—no acquired plus weight, to generate sufficient current to fulfill the needs of a space vehicle.

Chemical conversion, such as fuel cells, has the problem of limited weight in the fuel supply system, that is, they cannot carry as much weight as conventional power sources.

Flight Sciences Laboratory currently is working in the field of the plasma thermocouples which into the basic principles and characteristics of this type is much rather than direct application of it.

Progressive work has enhanced the study of superoxide combustion, solution of basic problems in which could yield large advances in the propulsion of the future. For example, it would eliminate the need for the cathodes and deliver in a compact.

In this regard, the burning takes place of superoxide velocity, i.e., the "detonation" is superoxide. Detonation is defined as the wave front at which chemical reaction (burning) takes place at a very high rate, with other the wave or the burning reaction being that which occurs.

Being Scientific Research Laboratory effort is in this organization a being deal with oxygen and propane in the burning reactions. Only one or two persons at BRL are working on this at the present time.

The instabilities in the wave front are caused by submicroscopic in the burning reaction in this case the oxygen, propane, methane, researchers indicate that the instabilities in the present properties can lead to success in holding the wave front constant and yield superoxide combustion.

Flight Mechanics works in the field of plasma research in all types of clouds which it, regardless of how, who or where they at BRL, does one a test flight above 50 mi. from earth surface and flight below that.

Among the problems Flight Mechanics studies are: thrust programming and its relationship to the optimal trajectory, control problems such as heat transfer from the boundary layer to the body surface and other related problems.

In addition it works to plan the optimum trajectory for any given mission within the given constraints (such as fuel available, vehicle size, etc.) in short, all the usual design loads which

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Research was selected to develop build and install the ground-based antenna system. Engineering and technical direction are under the guidance of the Army Signal Research & Development Laboratory (SRDL) and AFOSI are the other prime agencies responsible for the Project.

These communications systems, together with simultaneously receiving and relaying messages, will be similar to that which is being developed now covering half the world.

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result from the compromises which are required in any vehicle design.

Researchers have found that how one flies the trajectory, steering, will affect the design of the vehicle itself. Therefore, what they are seeking is to develop theories which will hold for general configurations. If they are able to accomplish this, it will suggest specific design of vehicles for the various missions since then, will be at least half price built established for some of the parameters involved.

Supersonic Boats

One part of aerodynamics work in Flight Sciences Laboratory is devoted toward trying to understand more about supersonic booms or shock waves. The laboratory seeks to establish that relationship of the boom to lift and drag and also the relationship of vehicle volume and geometry to the far field pressure distribution (of the shock wave).

A second area of sound waves effort is hypersonic glides which according to Boeing researchers, at altitudes of more than 10,000 feet, are competitive with other forms of transport. However, Boeing designers also feel that in the near development of a new concept principle would quite probably and the economic feasibility of the hypersonic glide.

Another effort in this same general area is the study of recoverable booster heat load to it, how soon that is over it is due to be worth the effort and much other data is it important to the subject.

The aerodynamics research team says that there is a need for a good three-dimensional hypersonic wing theory, and actually are doing some work in this area.

Then are studying flow field interference as supersonic regions, including some work in a Mach 2 to Mach 4 wind tunnel. Then are investigating the stress relationships of configurations such as the hypersonic intake and turbine. These exist in a linear design which includes a Mach factor for the relationship of configuration, but what everyone is hoping for is a new and good nonlinear theory for this relationship.

Aerodynamics investigators are anxious to get into the field of noise generated by turbulent wake powerplants (turbojets, turbofans, etc.), which they currently cannot do due to limited facilities. However, they will be able to pursue on-aircraft in this field in the new building.

The approach used by Dr. Hans Brenner, head of the Solid State Laboratory, is slightly different than that of the other laboratories. Here, Dr. Brenner adds all prospective staff members exactly where their fields of interest lie, to see if it falls into the overall

pattern of the laboratory's efforts. In addition, he has three sub-area of the equipment which they feel that will require in performing their research, from which they will have an idea of the amount of money involved.

One field of interest at the lab currently is that of ultra sound, in the range of 10⁷ to 10⁹ cycles per second, which are sound "interesting effects" in the range of 10⁷ amplitude and supersonic is being studied.

Also an investigation in the damping and absorption in relation to the frequency spectra.

The laboratory is working toward a new approach on fracture propagation. The main effort will be concentrated at low temperatures, that is, at temperatures: currently is 4 deg. Kelvin, or minus 269C.

Work also is aimed at re-energizing the leading concepts of beam klystrons, maintaining a thorough examination of the crystal structure. The laboratory also intends to get into ceramics studies.

When an attached work was contemplated in order was, it will be divided into 40% in solid state, 10% in ceramics and 50% in other materials.

One goal sought is a way to observe the transition in a material from the brittle to the ductile state, also, to ascertain those characteristics of a material which relate to stress-strain and fracture propagation.

One problem the laboratory faces, according to Dr. Brenner, is finding economists. This is a new field, one which has no standards to work in naturally. It is still a very unexplored area, a secret, Brenner says.

Discussion of the nature of the work, Dr. Brenner pointed out that it has been discovered that aluminum and copper precipitates do not hinder contact in rain-free, smooth, present aerodynamic. In activities, he says, it is the cold work which will hinder the materials.

Further along this line, it may possibly be that a comparison change will go globally to materials which are in-house, brittle.

Usually, in mathematics, the procedure has been to try and develop mathematical expressions for the solution of the particular problems. In Boeing Scientific Research Laboratory, mathematics are active, however, some of the reverse holds true in that scientists know the general problem and a solid and better mathematical expression for it and solutions to it.

Work in the laboratory falls in several general fields—some phenomena and aerodynamics, electromagnetics, devices and plastics, some solid state, electronics, probability and statistics, operations research and communications. This last category covers such subjects as systems analysis, queue theory, linear

and nonlinear programming, inventory control and scheduling.

Type of person sought for work here is a Ph.D. with 30 years' experience in particular fields, yet one who is able to talk to engineers and physicists about their work at will.

Type of work done includes what the laboratory calls consulting problems, extensions of consulting problems, operations and research.

Consulting problems is the work between the mathematician as called on by engineers or physicists to give some help with a particular problem or specific problem area in mathematical terms. While this area engaged in this type of consulting work, it frequently leads to development of new techniques applicable to the general type of problem. As he works, the mathematician may come across new areas for use of this mathematics or he may find new areas of application for classical mathematics or he may move into new mathematical areas entirely.

This is the extension of consulting effort, where the efforts are not further than the point where the problem is solved. The particular problem on which he is called on to consult in the first place.

Extension in developing methods and teaching visiting engineers better mathematical handling of their problems. Here they gain knowledge of work done which is known in mathematical circles but is not in general engineering, such as new mathematical or new work in handling old problems.

Engineering problems in consulting work, many researchers will have a feeling of assurance only a problem area which is not quite defined. Here they will seek better mathematical formulation for these problems area.

Also, they may assess those areas where there are both concrete problems which can be expressed mathematically.

Basic Research

Last part of the mathematician work is research, basic research for its own sake but still not totally random. It is the feeling in the mathematician laboratory that the personnel who are added to the staff should, as in the case of the Solid State Laboratory, have interests which fall generally within those in which the laboratory is working. This is not to say that areas have to be immediately useful or generally applicable, however, they should be in areas which are compatible with what the company might be interested in in later years.

In addition to the nine people mentioned working with the laboratory, mathematicians research has considerable from universities who are specialists in particular fields.

As far as is known, according to



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laboratory director Dr. Colvin, this is the first such mathematics research group in the aviation industry.

Research is determined, initially, what goes on in space between the earth and Mars and the sun and Meri in the work area of the Geosynthetic Laboratory. It wants to know very much about the nature of the gas and particles in the regions of the inner planets, i.e., those closest to the sun: Mercury, Venus, earth and Mars.

To start with, it is investigating the fluctuations of the ionosphere, which now indicate the properties of a space "atmosphere" by which the sun's protons would travel to earth from the sun.

The laboratory intends to make the investigation by means of time-correlated measurements of very low frequency radio wave transmissions along a belt in the northern hemisphere. If significant fluctuations are detected by means of the time differential in the VLF transmissions, it may well indicate that the sun's pressure waves (disturbances, photon particles) may very well be reaching earth and beyond by means of a conducting gas, which although extremely thin acts as an "atmosphere" such as the sound waves are transmitted on earth. The laboratory's observations will be of signals transmitted by various stations, commercial and military.

By measuring the time history of these signal strengths, it can display various aspects of the transmission. Additional research will be done on lowering more of the nature of the various phenomena.

In the investigation of the regions of the outer planets if Saturn's Cassini's ideas are correct, shock waves from solar storms can be calculated.

This tracking waves situation may also have an effect, researchers indicate, on signal propagation from space vehicles. It may affect also magnetic waves of space vehicles at densities of particles or gases in space are far from present estimated values.

An additional space phenomenon which may affect vehicle traveling through this medium is that of charge buildup on a charge while traveling through various charged particles and thereby attracts a halo, "atmosphere" of charged gases and particles around it. However, balance of the vehicle may be affected to depend of this if it becomes a major problem, or it can possibly be turned into propulsion.

Boring researchers point out that there is data available from the government on ionospheric characteristics and magnetic storms, but what they are trying to uncover are the mechanisms by which magnetic storms produce their effects.



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POLY INDUSTRIES

NERV reason, the weight per square foot required by the various heat shields was: copper 13, stainless steel 15, beryllium 2.5 and phenolic nylon 1.5. Besides providing a clear weight advantage, the ablator shield also has the largest energy potential, and it could be used to much greater advantage if the power of the launching rockets was increased.

Selection of a configuration for the NERV is easy when the first condition—the consideration of existing ones comes, but they were all too large for the fourth stage of the Apollo D-6, the first rocket considered as a launching vehicle. Scaled down versions of the existing ones came, some then modified because of the large quantity of aerodynamic data available in each one. In this study of four basic ablator-type geometries G.E. had developed in previous work, final choice of a configuration went to the NERV shape.

An upper weight limit and a maximum volume limit had been specified so that the main design trade-off was between volume and the ballistic parameter $W/C_d A$, where W is the gross weight of the vehicle, C_d its drag coefficient and A the characteristic area of the vehicle used in the calculation of the drag coefficient. The NERV shape had the lowest ballistic parameter which indicates that it requires the least amount of shielding material, and its volume was the nearest to that required for the NERV mission.

Fear Stage Rocket

During the major portion of its flight the NERV vehicle will remain attached to the final stage of its launching rocket to improve its stability and assure that the evolution package will not tumble through space. Under present plans, the launching rocket for the NERV experiments is the four stage Apollo D-6.

At 120 mi. altitude, the evolution package is telescoped forward out of the forward end of the nose cone. This package resembles a photograph of the nose cone in which it must be handled. It is made up of 21 slabs of Ethrel of Englehard G-5 condense. It must be kept within the temperature limits of -54°F and $+26^{\circ}\text{F}$ and away from the light. In addition, heavy shielding plates are provided fore and aft of the evolution package to remove the possibility that the particles which strike it will enter through the small side windows and make a trail along a one of the evolution slabs rather than going through several of them.

A small electric heater at the rear of the package will rotate the cone 160 deg. during the flight so that all of it will pass the low density side window. The experiment the evolution seal and the method of exposing it is con-

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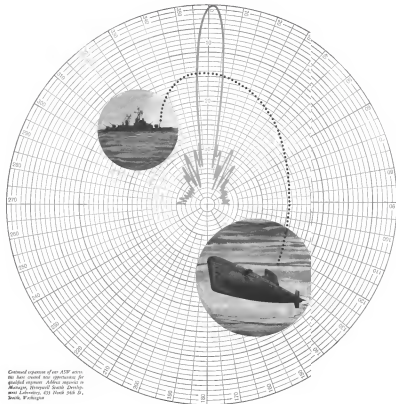
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designed to be an improvement over previous work which obtained this type of data from sounding rockets and sensors for vehicles at White Sands and other test facilities.

The NERV vehicle and the fourth stage of the Agena D-5 to which it is attached will be spinning from 600 to 735 rpm at burnout.

This will ensure that the vehicle will stabilize along its line of flight at burnout but it also will cause a problem during re-entry. The vehicle will have an essentially tail-first attitude to the ground after it poses maximum risk.

At 200 mi altitude on the way down, the cushion pack will be actuated and the shutter closed. The fourth stage rocket will be separated at 120 mi and, at 110 mi. The nose cone will be designed to last about 40 rpm.

At this point, there is no possibility that strong inertial forces due to rotation will prevent the nose cone from reacting to proper aerodynamic behavior and turning over so that its heat shield will be pointing forward.

The SARV shape is stable in tail-first flight over a small angle of attack range, and the vehicle will not encounter those over the NERV test systems.

Maximum Heating

Maximum heating will be experienced at just under 60 mi, the speed at this point will be approximately Mach 15 and the design reentry angle is 56.5 deg. The maximum subsonic velocity of the vehicle will never reach a temperature of 300°F because of the inherent insulation effect of the ablative material. The peak nose and lateral loads were estimated to be 99.5g and 16.6g respectively. The peak dynamic pressure will be approximately 3,415 psi.

It is estimated by GE that the system could be made to withstand an air-actuated water impact with a weight increase of only 30 lb. This is not a part of the design proposal, however, and it is planned to develop a 4-17 ft air-actuated start-type parachute at about 10,000 ft altitude. The opening shock of this chute will not exceed 40g and it will slow the vehicle to a speed of 50 ft/sec when it hits the water so that it will experience a shock loading of 60g.

Recovery of the vehicle will be effected by a 154-ft step and two air-craft under the GE proposal. On the basis of three and four paratroopers in its horizon accuracy of the propelling rocket and the dispersion expected for the ballistic parameter of the NERV, that is 95.4% of the design the re-entry vehicle will land within an area 132 x 400 mi long and approximately 13 mi wide.

The step will be on station in the middle of this area during a firing, and



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ARTIST'S CONCEPTION depicts NERV vehicle in flight above the earth.

it will need 7.75 hr. to reach the furthest point in the predicted area of actual impact.

The aircraft will be at the midpoint of two equally divided areas within the impact zone. One of these should be able to fit over the nose cone within a maximum of 10 min after impact. GE accommodates that the aircraft drop long-burning ramjet boosters, reprogrammed boosters dye marker and a UHF floating beacon upon lighting the nose cone.

Location Aids

The recently vehicle itself carries a number of location aids which have been exhaustively proven during the past year. First, a large quantity of "V" band radar chaff is ejected from the vehicle at an altitude of 10,000 ft. Tests have shown that these ten steps of aluminum foil can be easily detected at 150 mi. and that they give a return for over three hours when dropped from an altitude of two miles.

Automatic gases of the parachute are released. Tests have shown that this gives good radar return from distances up to 150 mi. Third a radio beacon with 150 mi. range is carried in the nose cone which transmits after impact. Fourth, aluminum dye marker is released from the nose cone after it has the water. Fifth, a high intensity strobe light is carried.

The light is visible at 5 to 10 mi. and with a fall cone from an altitude of 8,000 ft.

Metal-Coated Plastic Has Storables Future

San Antonio—Step toward encapsulation of modules and back in missile systems has been accomplished here by Southwest Research Institute's Chemistry Department.

Successful metal coating of a plastic container containing a liquid could be applied to development of a container which would be an integral part of a fuel or oxidizer formula. Southwest Research Institute's investigation leads toward producing such capsules of 500 to 1,000 micron diameter which would permit safe use of exotic fuels of a toxic nature in missile systems.

This method also would allow use of oxidizers, droppers or special additives which would come into contact with the other materials making up the rocket fuel formula only when an evaporating chemical reaction which would alter the propellant's nature or produce corrosion resulting from action of material on metallic components.

It is believed that encapsulation of materials will also be valuable in overcoming the effects of extended weight losses on fuels and lubricants in space flight.

Southwest Research Institute technicians that a powder was applied to the wet specimen allowing capable to ensure adhesion of the subsequent metal coating.

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FAA Analyzing Low Cost Data Link Unit

By James A. Fosse

Atlanta City, N. J.—First detailed report on Shoroburg Carlson's approach to low-cost equipment for the automatic air-ground communications system (AGACS) program to be evaluated over the next six months by the Federal Aviation Agency has been presented to the Annual Fall Assembly of the Radio Technical Committee for Avionics.

The AGACS evaluation in FAA will place the Shoroburg Carlson system in comparison with RCA's approach which incorporates a modified version of its military data link which has been described previously. The new system was described by Thos. H. Giesche, acting chief of FAA's Surface Avionics Division at the National Avionics Facilities Experimental Center.

The RTCA meeting was devoted to discussion on progress in adapting the

company's present air traffic control system to meet the modernization needs of the next decade and the related problems of air safety, air traffic control and voice operations from government, military and industry.

One of the major problems given the FAA, Giesche said, is the design and planning of a future automatic air-ground communications system. In addition to the communications problem, automatic computers will be required for expanding existing air traffic control functions. Those computers will require, he said, an automatic communications system that permits the reliable processing of data inputs and outputs to and from aircraft. All aircraft flying within the controlled airspace must be equipped so they can participate in using the new automatic system.

Thorough analysis will be required

before such a system can be adapted, he indicated, to protect the investment by the government as well as the expense to the aircraft owner, and the system must be such that it will last for a long time into the future.

A number of decisions will have to be made in deciding upon the basic requirements with due regard to:

- Understanding physical conditions in flight to assigned radio communications.

- Price limitations for equipment that must be purchased in the private aircraft owner. The FAA considers that it may be possible to simplify the procedures and equipment to such an extent that participating automatic air traffic control will not require more than an expense of approximately \$500, using plug-in equipment to existing equipment.

The most important requirement is for compatibility. Large scale integrated networks require compatibility and a long period of growth based on established standards. Air traffic control problems in New York, Chicago, and Los Angeles accurately are seen as air traffic communication system but the system's purpose is defined if it is suitable for those areas.

The basic standard for voice transmission is a tone band of about 3,000 cps bandwidth. An automatic digital communications system that requires this total bandwidth in one single data channel is a 750 bit per second system. With such a system, however, a second mode would be required for voice communication.

To meet the requirement for a second radio, the digital data must be transmitted through a sufficiently narrow bandwidth so as to limit the data bit rate to approximately 50 to 100 bits per second. With this approach, where a narrow bandwidth of 100 to 200 cps is utilized over the data transmission, the aircraft can be called on the same radio frequency either in voice or in data.

Because the 50 to 100 bits per second rate is the basis of existing teletype techniques, the type of system would be able to make use of now existing facilities, eliminating the need for an additional ground-to-ground supporting system to forward all ground data to and from air traffic control system.

Another advantage of a "voice plus data" system is that it reduces transmission through HF and LF channels. Also, punched tape can be used as a connecting link to automatic computers, and the message duration of one

second for the shortest message is in accordance with the requirements of ground station facilities.

The FAA will continue to analyze both the 750 bit per second RCA system and the 50 bit per second Shoroburg Carlson system during flight tests over the next six months after which a choice will be made. Giesche said. A primary advantage of the 750 bit per second system is the capacity requirement for areas with dense air traffic but, he said, there seems to be much less complexity and more flexibility and reliability in the narrow band system. He added, however, that it is too early to draw any conclusions as long as flight experiments and testing has not provided practical results.

The Shoroburg Carlson system employs the installed standard aircraft receiver which supplies an audio frequency signal to a tone receiver which, in turn, feeds a digital signal to a decoding and display unit. The three outputs of the display unit are a loop display for digital (or coded) messages, a cockpit printer for longer messages such as clearance or weather reports, and a teletype circuit to the pilot's headphones which tells him that ground stations wish to contact him in voice.

The system also uses the aircraft's standard radio transmitter which can act with both the automatic system and the pilot's microphone inserted into the microphone pressure (altitude) sound messages, and the aircraft's call which is set up as a call signal. This information is fed to the automatic system which feeds a tone layer and the transmitter.

The FAA contract with Shoroburg Carlson also calls for the study of cockpit display panels. Experimental models will be delivered from two subcontractors, Foster Electronics Corp. and Teletype Corp. Each of these is the use of one standard cockpit instrument such as an altimeter and will display both the pilot's position at 0.25 in. type. The printer should contribute to the pilot's convenience. Clearer printed in clear text seems to be preferable to messages received by voice or on a visible visual display and therefore a loop display. The printer will be compatible with the stored message system and add-on to a loop display for a minimum number of stored messages. It is also being designed to be responsive enough for use in printed message aircraft.

RTCA's special committee, made up of representatives from the government, military, airlines and industry, which study and coordinate recommendations on specialized avionics problems is:

- SC-29. This committee has completed a study of the problem among



Peking Airport Control Tower Activated

Modern communications equipment, installed with Soviet aid, is a feature of the control tower now in use at the new Peking airport. Tower is located in an eastern suburb of the capital city and one handle teletype and teletype aircraft.

pilot adherence to use automatic and autopilot complex to make automatic approaches with the ILS instrument landing system. During performance requirements have been drawn up for both airborne and ground equipment which the committee believes will ensure that a pilot can make a precise and smooth automatic approach to a cutoff point 5 ft above the runway.

- SC-31. This committee was set up to formulate maximum performance standards for airborne self-contained approach aids. It has completed requirements for airborne approach aids, including not only the scanner but also instrumentation, heading reference, and other elements to provide a measure of ground speed and drift angle, and will shortly begin work on standards for a doppler drift-measuring computer.

- SC-35. This committee is developing recommended minimum standards for airborne voice equipment, with emphasis on test procedures both in the laboratory and at certified in aircraft to assure standards being met. Expected dates for completion for various systems are: 1968, VOR, ILS, runway beacon, 1969-71, ADF, VHF and DME.

- SC-36. This committee is developing "national" standards for the ACT radar beacon system, to use the FAA in establishing a technical system, under equipment to be carried by conventional aircraft, pending information on light weight requirements for private aircraft. When this information is available, a

minimum performance standard for all ACT radar beacons will be drawn up.

- SC-37. This committee was established to describe minimum performance standards for radar altimeters. Because the principal use of radar altimeters today is to measure pattern flying, pending their possible use in automatic final-out and landing system, only requirements for these only designed systems are being drawn up at present.

- SC-38. To determine which portable distress devices carried aboard aircraft could potentially cause interference with aircraft voice systems, this committee has undertaken a study of these devices including beeping aids, portable transmitters and distress transmitters, and portable radios and television receivers. The results have indicated that beeping aids are not interference sources, that portable transmitters and distress transmitters which meet MIL-1-16916 or compatible specifications are not, and that portable radios and TV sets potentially can cause dangerous interference.

One of the problems being the committee has been the lack of quantitative data on signal levels which can be tolerated by aircraft voice equipment.

The FAA's Bureau of Research and Development has been asked to provide this information. Until this time, the RTCA has recommended that the use of these sets be discouraged on conventional aircraft as a safety measure, and that the potential hazard is brought to the attention of private pilots.



Slide Rule Speeds Countermeasures Calculations

Electronic countermeasures calculator, a portable slide rule developed by General Electric Co., enables electronic countermeasures and radar engineers to solve basic countermeasures problems quickly. Calculator can be used to determine the power received at a radar antenna for given wave power power, the sensitivity required of an electronic countermeasures device receiver to detect a radar signal of a given power, the power required by a jammer to cause a radar target when the jammer is not located at the target's position and the minimum detectable range for a radar set design. Engineers should be directed to John R. Baker, GE, Light Military Equipment Department, Utica, N. Y.



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*The new ATLAS erector system is supplied by Goodyear Aircraft Corporation, Arizona Division, Litchfield Park, Arizona, under contract to Convair Astronautics Division, San Diego, California, prime contractor to USAF for ATLAS.

A-1000

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Control Center Designed for Expansion

San Antonio, Tex.—Designed to stay ahead of anticipated air traffic demands of the future, the new \$5 million-plus Federal Aviation Agency control center here features an expandable design concept suited to intelligence and optimum use of new equipment—some which is still in development—that will permit constant surveillance and control of all civil and military aircraft within a radius of 200 mi.

San Antonio Air Route Traffic Control Center is the first of 29 such ARTCCs going up around the U. S.—some which will be capable of prolonged operations run after a severe weather attack—and its 45,000-sq-ft of usable space compared with the 7,900 sq ft it had in its previous quarters typifies flexibility needed at the Federal Aviation Agency in to provide adequate coverage of the 175,000 sq. ft of federal airspace in the future.

Rapid Growth

Although the new center has been operating only since midnight Sept. 10, indications are that another 10 ft. width may have to be added to the current 60-ft. clear span as approximately three to five years. When the San Antonio ARTCC moved into its present facility in 1956, it was thought it would need another 2,000 sq ft in about two years. Then with a growing epidemic of near misses and the Grand Canyon collision, there was a demand in that time for increased control that resulted this center requiring about 15,000 sq ft.

It was this type of outgrowing growth that set FAA planners working for two years to develop a new center concept that would be capable of rapid expansion in maximum time and provide the best layout not only for equipment in use but to consider new devices still under study, such as the long computers that will automate flight plan material handled manually.

San Antonio ARTCC initially was envisaged as including nuclear attack capability. Hence its distance from the center of the command place is outside a so-called "D-ring" considered far enough from ground zero to obviate need for this protection, which would include blast-proof structures, such as provisions to clean the structure of radiation effects and provisions for optimum personnel data or for work without their having to leave the center.

Local part of the new structure is a 60-ft. x 160-ft. clear span operations room with 34-ft. head room over a basement of similar width and length and 12 ft. 6 in. head room. Ceiling gets all



OPERATIONS room of the new San Antonio, Tex., air traffic control center missions some 60 ft. x 160 ft. with a 34-ft. high ceiling. As life increased in flight data position where flight stress no made up; flight controls positions are at right and left. Radar departure controllers are located at stands behind the flight controllers. Black-painted adjustable louver is ceiling lights prevent whatever flaming of any fire to cut illumination in other control area. Below is the center basement which houses all black boxes for equipment mounted in the view directly above. Units here also provide temperature and humidity control for optimum operation life of equipment. Note the white type ceiling construction (between the banks of fluorescent lights) which provides a 190 lb. strength with only a three-inch floor thickness. The construction also provides for simplified entry for maintenance when control center equipment is relocated. Fire-timber layout was designed for quick accessibility for maintenance and operation.



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Explorer VII Silencer

Timing silence for Explorer VII will shut down the satellite's transmitter after one year in orbit. The one-half pound device will prevent Explorer VII from cluttering the radio spectrum with signals after the desired data is obtained. Tested and designed for the Ames Research Center Agency by the Balboa Watch Co.

"black boxes" of the electronics gear used for operations personnel directly under their feet in the instrument paneling. The device is designed for use in aircraft and also allows for cooling temperature and humidity control of the black boxes at levels that might possibly be uncomfortable for operators.

With an eye of building black rather than concrete construction, permitting easy fireproofing to provide larger area. The 5 ft. 6 in. high overhead stud trusses allow width to be expanded to 90 ft. their open and bays can be developed to use, economy, economy. Flooring is a steel decking, which has been used in construction in other sections of the country but is believed to be new in the area. The black-box construction is composed of metal stud and approximately three feet across permitting a floor thickness of only three inches while providing a strength capable of handling 150 lb./sq. ft. Where areas of pure are paved, cold floor thickness is approximately 11 in.

This feature, though more costly than conventional structure which would necessitate flooring approximately six inches thick, American West was told, allows easy drilling through the top two feet, when equipment is run off around or new equipment is installed for connection to the basement.

Plenum air circulation is arranged so that black painted corrugated shutters beneath the loops can be opened to draw air from the desired area of the

room for example where the main operators wish to provide maximum visibility of their presentation.

Current arrangement provides for three radio control positions. As equipment purchased is delivered it will be installed, to provide full coverage, using microwave beaming to pick up radio returns from areas outside San Antonio.

Current microwave tower takes in radio signals from Lockheed AFS, next will be agent of signals from Houston radar, and eventually radar coverage will be transmitted from five sites to provide at least 3000 surveillance area, according to San Antonio ARTCC chief Gerald Fry.

Construction of the building was undertaken by private enterprise with the structure being leased to FAA for a 10-year period with renewal options.

Balboa House 1. Dea financed the construction through a loan bank and has responsibility for maintenance and structural development. General contractor was Walsh & Herney, San Antonio.

Dea believes that on the basis of results he will be in the clear in 10 years and if need be would be able to convert for another enterprise. He noted that the general development of the San Antonio area is in the direction of the center building and anticipates no difficulty in locating new tenants should FAA move.

Remote location of some of the other ARTCC sites will probably make it necessary for the government to assume the responsibility for construction. Also obtaining financing for such features necessary to defense against nuclear attack might also be difficult to obtain.

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East Coast and Southeastern sales and service are provided through the administration of the Aircraft Corporation and its several branch locations.



Illustration of this Binks spray booth is virtually showrooms, enabling customers to work quickly and efficiently.



At Douglas Aircraft, Long Beach, Calif...

90% of all DC-8 painting done in 3 Binks spray booths

A whopping 155-ft. Binks dry-type spray booth accommodates the main fuselage section of a DC-8 jetliner. This is the largest of three booths used for priming and painting. Entry is through large roll-up doors at each end of the booth. Hanger-type doors along one side of the booth provide a 10-ft. clear opening for easy roll-in of other large assemblies.

Twelve powerful 20,000 cfm exhaust fans ensure positive removal of fumes and overspray. Intake and exhaust air is filtered to prevent dust entry and keep exhaust streams free of paint pigment.

Production line requirements. Design and installation of these spray booths combined the talents of Douglas production personnel and Binks spray painting

engineers. Of prime consideration was the need to integrate the painting operation into the production line. Capacity and reliability were a must as a jump-up in painting would seriously hamper other production steps. The dependability and efficiency of Binks spray guns also contributed to an assurance of smooth-flowing production.

Investigate this finishing bonus. In addition to bringing a wealth of experience to every finishing problem, Binks engineers bring a complete line of standard manual and automatic equipment as well as electrostatic and airless spraying units. They have an "expert" person to sell. "You can mean dollar savings to you," can mean a finishing system well suited to your requirements. Call, write or visit today.

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centric for each wheel and a pressure metering valve for each heated wheel. It works like this:

• **Roller frequency** from each wheel unit is sensed as wheel speed by the control box, as the speed changes, a direct line from each wheel follows the change while the receiver circuit follows the speed of the direct rolling wheel.

• **When difference in wheel speed is sensed**, control is sent to the pressure metering valve to reduce metered pressure, causing a proportional—not linear—rate to the difference.

• **Brake pressure** should vary nonlinearly to "fall off" at approximately 2500-psi. Company, and actual values will be established with requirements of the specific aircraft using the ML 2.

Hydro-Air pointed out that high performance aircraft, which have high landing speeds, tend to experience an "air" "grip" problem because of high brake force requirements and the resulting gear deflection.

Components of the Hybrid ML 2 Hydro-Air can be used to convert central braking system to wheels; there is a fully modulated, proportional control system. ML 2 system is about half the weight of the original Hybrid system and control box is completely instrumented, eliminating outside electronic effects.

Hydro-Air has tested the ML 2 system on the company's landing roll simulator. Flight tests now are being arranged, the company said.

PRODUCTION BRIEFING

Lockheed Aircraft Corp's Model and Space Division, Santa Fe, Calif. will install a 96-in. diameter space frame machine for the production of missile and space vehicles. The \$500,000 machine will, measuring 48 ft. high by 72 ft. wide, is produced by the Heland Division of the Stinger Corp.

Northwestern, Inc., Hawthorne, Calif. will produce additional two-axis control computers for the Lockheed F2V under \$416,200 follow-on contract. The computer provides the control input to the aircraft's navigation system.

Aerco-General Corp., Anna, Calif. will conduct basic research studies of chemically exploded wires and films under contract from the Army's Office of Ordnance Research.

Standard Process Steel Co., Jackson, Pa. is developing heavy-duty bolts at its new meth lab. The company says that a 125,000-lb tensile bolt would, on a strength-to-weight basis, be equivalent to twice the weight of high strength steel bolts.

Space APU Works Like Steam Engine

TOMMORROW, Cold—Well known principles of the steam engine have been applied to design of a hydrogen and oxygen-fueled engine to produce non-propulsive power for fast duration space missions. Engineers at Vickers, Inc. have under development a three-cylinder engine, 10 in. in diameter and weighing about 15 lb., which produces up to 40 hp.

Increasing applications of the Vickers engine would be as an auxiliary power unit for short duration out of atmosphere flights such as an X-15-type rocket-powered aircraft, right mode or for longer duration missions of several hours that might be made with a Dovesort-type glide re-entry vehicle.

The engine operates on the combination of hydrogen supported by oxygen which yields a temperature of about 5500°. Hot gases from the combustion chamber enter exhaust through poppet-type, variable displacement valves, similar in operation to the valves in a steam engine.

Gases expand to drive the pistons in an air-cooled combustion engine and are exhausted through ports in the cylinder walls.

No need exists for cooling cylinder with inert fluid since an average heat temperature of about 2500° due to heat loss during expansion. Exhaust temperatures are of about 1000°.

Lubrication is provided by an oil mist which is pumped overhead with the exhaust.

Engine's Advantages

Advantages claimed by Vickers engineers for the non-propulsive engine are:

• **Lowest propellant consumption** of chemical fuels. Binks specific propellant consumption (SPC) in lb./hp./hr. is about 1/4 that of hydrogen peroxide 1 lb. of methane and liquid oxygen. On a dry basis, the engine operating at full rating (40 hp) requires an SPC of 0.0001 lb./hp./hr. for hydrogen peroxide, 0.0002 lb./hp./hr. for methane and 0.0003 lb./hp./hr. for liquid oxygen.

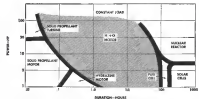
• **Low fuel weight** of about 15 lb., not counting the alternative to hydrogen peroxide. Comparison by Vickers shows that for mission requiring low power (up to 1 hp) for short duration (1 to 1 hr.), a hydrogen motor is more efficient than the overall system weight required. Solid propellant systems are better for even shorter duration, requiring up to 10 hp. Solid propellant turbine systems require for over 10 hp, which are not required for more than 0.5 hr.

Duration less than 100 hr. at normal power will probably be done with or without the nuclear sources or solar cells. Solar cells require little or no consumables.



BACKUP of the hydrogen-oxygen hybrid machine power unit shown is coupled to an alternator in series with a hydraulic pump. Engine, which is 10 in. in diameter, is the light-colored part at the left of the assembly.

OPTIMUM WEIGHT NON-PROPELLIVE POWER SYSTEMS



FOR SHORT DURATION missions of 1 hr. to 100 hr., the 10 hp. engine is superior. Beyond 100 hr., other means of power generation are more economical, due to propellant consumption.

able fuel but are necessarily costly from the standpoint of overall system weight. For all power requirements in the medium range from 1-100 hp up to 40 hp, Vickers engineers calculate the hydrogen engine as superior.

• **High peak power.** Engine is good candidate for use at 5,000 rpm, fuel consumption being determined by the load imposed on the engine. Fuel is automatically metered by the variable displacement poppet valves to keep open constant regardless of output requirements.

• **Commercial operation** at part load. The same governing system also permits the engine to operate at low power outputs if reduced fuel consumption. Fuel is not expended in keeping the system running when it is not the power output is required. Economical operation is possible during the cruising pattern.

of a mission when load requirements are not as great as during launch, cruise or landing. Hydraulic power requirements may be great during these latter phases but not so high during cruise when reaction controls are used.

• **Reaction control** for other equipment. Disposition of heat from other sources such as the ecological system, electronic components, hydraulic system or aerodynamic heating, can be accomplished by using the cooling capacity of the liquid hydrogen fuel to absorb excess heat from the vehicle through a heat exchanger.

In addition to reducing excess heat from the vehicle, Vickers says the hydrogen-oxygen engine system can be integrated with the occupant's breathing apparatus. Oxygen is not weight. Also, low temperature of stored

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NON-MAGNETIC PROPERTIES...
"No-Mag" cable is made from type 304 stainless steel. It remains non-magnetic after severe cold working—in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or similar operations.

This non-magnetic property of "No-Mag" cable eliminates instrument interference from cable magnetism.

CORROSION RESISTANCE...
New "No-Mag" cables have corrosion-resistant qualities similar to, but slightly better than, cables made of standard stainless steel.

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The thermal expansion characteristics of new "No-Mag" cable are much closer than those of standard stainless steel or carbon steel cables.

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to the characteristics of chromium alloys used in aircraft. This greatly simplifies maintaining cable tension under various changes in temperature.

HIGH FATIGUE RESISTANCE...
Improved construction and careful processing give new "No-Mag" cable high fatigue resistance.

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New "No-Mag" cable shows greater abrasion resistance than standard stainless steel aircraft cables.

TENSILE STRENGTH... While lower than that of stainless and carbon steel, is sufficient to enable replacing these, one for one, with "No-Mag" on many applications where the characteristics of "No-Mag" are required.

USE WITH SWAGED TERMINALS...
Swaged terminals can be applied to standard air dimensions.

COMPLETE RANGE OF SIZES, CONSTRUCTIONS... New "No-Mag" is furnished in sizes from 1/16" to 1" in all of the standard aircraft cable constructions.

liquid hydrogen can be used to freeze contaminants as carbon dioxide and every water vapor out of the system.

Kerosene from the auxiliary power unit engine also supplies a small amount of thrust which could be used in a jet attitude control system. Amount of thrust varies according to the load imposed by different air hydraulic components and is greatest when there is little or no load on the engine.

Victory has for some time been operating a test set up on a single cylinder hydrogen-oxygen engine in an laboratory. At this writing, the engine has operated for more than 30 hr.

Small Soviet Engine Aimed at Lightplanes

Moscow-Soviet Union claims it has developed a powerful, lightweight, new, high-altitude, small-displacement internal combustion engine that will be widely employed in the future by Soviet civil aviation.

Designed by Doctor of Technical Sciences Boris G. Shpilstein "after more than six years," the engine is now operating on Russian test stands. It has a rated output of 1,800 hp, although it is reportedly small enough to fit under the hood of a 65-hp Soviet Pobeda automobile.

Sokolovskiy Aviation, official Soviet air force newspaper, says the first experiments with the Shpilstein engine have shown that it "considerably surpasses a diesel in power and economy." Shpilstein said that "one of the main features of this new engine is the non-inflammable combustion process. A special program device automatically provides a given regime of engine operation."

High power with small displacement and low weight was achieved, it claims, as a consequence of a number of innovations and an increase in compression ratio. The combustion chamber's special design permits eliminating the harmful effect of fuel mixture knock and allows use of fuel which does not contain an anti-knock additive.

The new engine uses a new gear transmission engaging system developed by Leonid Yevgenyevich M. I. Novikov. Utilization of perfected and friction bearings has permitted considerable reduction in friction loss.

"We have succeeded in completely eliminating friction in the cylinders—the working pistons do not touch the walls during the compression of a number of technical innovations we have significantly increased the engine's operating life between overhauls."

"A substantial advantage of the new engine, as compared with previously-known types is its ability to operate on any fuel: gasoline, kerosene, mineral gases, or refinery waste products."



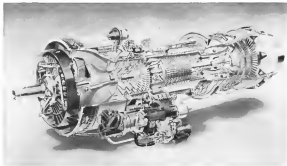
Cooling over Edwards AFB, Calif. (left), Northrop N-156F fighter shows strong family resemblance to the T-38 Talon trainer from which it evolved (AW July 20, p. 19). The Mach 1.5 fighter carries Subsonic air to its best working speeds on wings (right).



N-156F Flight Photos Emphasize Area Rule

Flight shots of Northrop's N-156F "Falcon" fighter" (AW June 15, p. 38) show its area ruled fuselage. The aircraft was designed for NATO and SEATO air forces. Company overcame a Mach 2 speed in first production line fighter through addition of an advanced thrust augmentation system to be applied to the General Electric J85 engines (AW Oct. 15, p. 17). Aircraft also has a progressive cooling system using water to cool air entering the engine.





BOLLS-ROTC Tyne two-stage high-compression engine will enter service in 1964 at ratings of 4,065, 5,345 and 5,730 thp.

Tyne Designed to Grow to 10,000 Teph.

By Robert L. Strafield

Mentored = Ultimate development plan for the Rolls-Royce Tyne turbo-prop within its present structure, engine rating increases up to 10,000 total equivalent horsepower (thp), along with further reductions in specific fuel consumption.

The Tyne includes a low-pressure axial compressor which, together with the propeller induction fan, is coupled to a three-stage turbine. A high-pressure axial fan compressor is coupled to a single-stage turbine. Engine combustion is provided by combustion chambers containing 10 straight fuel-flow tubes and an exhaust duct. Exhaust from turbines to compression air is by two central ducts. Reverse pitch and fuel control for the propeller are provided.

Engine also incorporates the best features of other Rolls-Royce propellers, plus a more sophisticated design.

Compressor air is taken down to rear of those used on the Comets. The combustion arrangement is similar to that of the Avon and Conquest, with cooling features proved in Dart propellers. Turbine disks, with extended root blades to keep the disk ends cool, are a feature of the Avon, Dart and Conquest engines. During the propeller spinners and on intake, some cool air is

Tyne is based on the Dart system. Variants of the Tyne are:

- **Tyne 11, Mark 506.** This is the basic engine which will power British Royal Navy's first six Vulcan-Van propellers, which will compress service air, not air for takeoff conditions, at 15,250 rpm. The Mark 506 produces 4,065 thp at maximum recommended cruise (15,000 ft ISA at 370 kt) specific fuel consumption is 407 lb/hp.

- **Tyne 11, Mark 512.** This turbo-prop is scheduled to power 14 of REA's Vanguard and 20 of those ordered by Trans-Canada Air Lines. It will also be fitted in 12 Short Brothers & Harland Britannia military transports ordered by the Royal Air Force. Increased power and lower specific fuel consumption, as

compared with the Mark 506, are due to higher turbine inlet temperatures. Its rated condition at 15,250 rpm the Mark 512 produces 5,345 thp. It has a higher maximum compression and maximum recommended cruise rpm of 14,100 and 15,500. Specific fuel consumption (25,000 ft ISA at 375 kt) is 416 lb/hp.

- **Tyne 12, Mark 945/10.** These engines have been specifically tailored for the Canadian CL-44 airliner. The first of the military version (the CL-106) is scheduled to be scheduled to the Royal Canadian Air Force is scheduled to be this month. They also will enter service with the 1961 with the five commercial transport versions ordered by Seaboard & Western and the 11 ordered by Flying Tiger Line (AW May 18, p. 41), plus the two ordered by Mark 945.

Mass differences between the Tyne 12 and its predecessor in the largest diameter propeller world (19.2 in. diameter 34.5 in. P) which means that the Tyne 12 is available at engine of propeller thrust in takeoff condition, at 15,250 rpm, the Mark 945/10 produces 5,730 thp and, at 14,000 ft ISA, at 320 kt, specific fuel consumption is 392 lb/hp.

The Tyne also is specified for the French Regent NATO and subsonic, surface aircraft, for which propellers

orders have been placed, and for the Navy's Sea King.

Cost of the Tyne is approximately \$140,000, TAE (three aboard ship) United Kingdom post, plus 12.5% duty charges. First four Comets production engines—those powering the first CL-44 (the RCAN's CC-106)—were delivered in June, 1959. Production at the Rolls-Royce plant in Derby, England, is building up to a 12-month rate, which can be increased with demand. About 150 of these engines have been ordered to date.

Tyne Development

Comets has now run 30-odd engines. Testbed and longer tests totaled about 11,017 hr as of Oct. 9, flying hours, about 5,160. Six 150-hr type tests have been completed, including two at the Tyne 12 rating for the Vanguard and two at the Tyne 12 rating for the CL-44. Tests included 450 hr running at 5,600 thp, at 25% over load on the initial Tyne 12 takeoff rating for REA's Vanguard followed by a further 150 hr at 3,000 thp, 25% over load, on the initial takeoff rating for the CL-44.

Initial Tyne flight development was carried out on non-extended installations on an Avon Lincolns, in which 340 hr have been flown. Advanced flight development was made by converting two two-engine CL-44s to three-engine aircraft to Tyne. One flying testbed, used for compressor work, has accumulated about 1,660 hr. Total hours put in with the first three Vanguard, to date, are about 1,660 flight hours. In addition to notified running, Rolls-Royce has 25,000 hr of full-scale component development running on the Tyne.

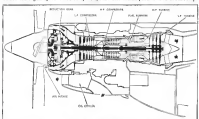
Following the Mark 945/10, the next stage of development which Rolls-Royce designers say the "developed Tyne 12 engine" will be available for service early in 1963. This engine will produce 6,100 thp. Compressor feeds it will be a relatively simple matter to convert current engines to the new rating on overhaul.

Compressor will involve new high-pressure turbine blades, first-stage low-pressure nozzle box with adjusted area to allow for higher temperatures at which the engine will run, corresponding change in fuel metering unit to allow a higher fuel flow.

Development up to 10,000 thp, within present engine frame size, would be accomplished by increasing the air flow and increasing turbine temperatures at the new and better turbine blade materials because available and as techniques of turbine blade cooling are further developed. Rolls-Royce is presently using Narbonne 105 as standard in production engines that is a nickel-



TYNE 12. Mark 512/10 engine is rated at 16 ft diameter at takeoff condition. At 10,000 ft, engine speed is 13,500 rpm, specific fuel consumption is 392 lb/hp.



CUTAWAY showing of the Tyne. Air-cooled turbine blades permit the use of high gas temperatures. The actual burning gas temperature of the R.Ty.12 is 1,700°.



LENGTH of R.Ty.12 is 140.7 in. Diameter is 41.3 in. Basic dry weight is 2,125 lb. Rating increases up to 10,000 thp are located within the present frame structure.



a comparison:

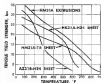
4 MAGNESIUM ALLOYS for elevated temperature service

A wide variety of elevated temperature alloys extends the use of lightweight magnesium into the critical 300°-800°F. temperature range.

Name your weapon—Jupiter C, Polaris, Titan, Discoverer, Falcon or Boreas. All make extensive use of elevated temperature magnesium alloys. Improved resistance to creep, increased stiffness and strength and exceptional creep characteristics are the long run of these materials. At elevated temperatures they maintain a high ratio of fatigue strength to static strength. (About the same ratio as unalloyed magnesium alloys at room temperature.)

SHEET AND PLATE

Alloys HK31A and HM21A have been widely used for many different parts in missiles, rockets and aircraft. Some of the most common applications include body skins, engine air inlets and ducts, nose fairings and nozzles, external and internal skins on control surfaces. HK31A exceeds the usefulness of light-



A comparison of elevated tensile yield strength exhibited by a selected magnesium alloy and the commonly used elevated temperature alloys.

weight magnesium to a temperature of 500°F and above. HM21A withstands temperatures up to 700°F and higher for short time periods. And it exhibits better creep resistance above 350°F and better static properties above 550°F than does HK31A.

FORGINGS

At operating temperatures up to 300°F, HM21A offers excellent mechanical properties, optimum creep resistance. HK31A has better room and elevated temperature properties up to 400°F. Both have good forgeability.

CASTINGS

Engine air inlets and ducts and housings for electronic guidance systems are examples of the many applications of cast magnesium alloys HK31A and EZ35A. EZ35A has good general properties in the 350°-500°F range. HK31A is recommended up to 700°F and above. Components of military systems weighing as much as 105 lbs. have been cast in one piece with HK31A. A new elevated temperature alloy for the casting is now in development and will soon be available.

EXTRUSIONS

Alloy HM31A has put the many benefits of elevated temperature magnesium into extrusion form. This alloy is used as ribs and stiffeners in missile bodies, instrumentation booms and external tunnel fairings for wiring and plumbing, etc. HM31A maintains high static modulus, excellent creep resistance and strength at elevated temperatures. Elevated temperature exposure at 600°F for 1,000 hours causes no change in room temperature properties and only a slight drop in creep strength.

ELEVATED TEMPERATURE MAGNESIUM EXCELS IN PRODUCTION

The elevated temperature alloys possess the best working characteristics of all magnesium alloys. Arc welded joints can be easily made and welding compatibility of magnesium alloys is excellent. For example, HK31A sheet can be welded to HM31A extrusion.

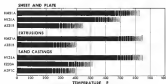
Weld efficiencies at room temperature range from 70% to 85%. At temperatures above 450°F, HK31A has a weld efficiency of 100%. The same goes for HM21A above 500°F. In general, preheating and stress relieving are unnecessary with these alloys. They can be readily spot welded and are not subject to cracking.

Machining operations can be carried out at extremely high speeds, with heavier depths of cut and higher rates of feed than are possible with other metals. All chemical treatments used to finish standard magnesium alloys are

applicable to the elevated temperature alloys, with the exception of Dow 7, which does not react satisfactorily on magnesium-beryllium alloys. For extended service above 400°F, the anodic treatments are preferred.

MAGNESIUM ALLOYS FOR ELEVATED TEMPERATURE APPLICATIONS

SHEET	HM21A HM31A
PLATE	HK31A HM31A
FORGINGS	HK31A HM31A
CASTINGS	HK31A EZ35A
EXTRUSIONS	HM31A



New alloys have extended magnesium's useful service temperature range.

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plant experience, knowledge and technical service.

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THE DOW METAL PRODUCTS COMPANY, Midland, Michigan
DIVISION OF THE DOW CHEMICAL COMPANY



F-100 Demonstrates Takeoff From Launching Shelter

North American F-100 Super Sabre demonstrates a takeoff

chrome alloy with stream additions, made by Harry Wagon in England that is now being delivered in solid blade form.

The F-100 is expected to go into service with British European Airways at a 600 hr. scheduled life. Ansony Wink was told. This is expected to increase to 1,000 hr. by early 1961 and 2,000 hr. by the beginning of 1965. The engine will enter U.S. domestic service at a nominal 1,000 hr. life, with a possible sampling program of 500 hr. in strip and check of two of the aircraft's first engines.

Rolls-Royce anticipates an overhaul interval of 100 hr. after three months after reaching the 1,000 hr. mark, with a possible shortening period of 1,500 hr. for the first 12 hr. of the first quarter of 1961. Plans at this point would be for component life development. Company also prefer to lead the conversion rating by the engine, which gives operational operation the benefit of safety expense.

Engine Details

The F-100's overpowered open-cycle turbojet gas turbine and turbo-propeller gas turbine (now) are mounted within a supercharger air intake casing. Passes gas into, 161, can be varied to suit conditions. The integral oil tank is formed by a steel casing completely surrounding the rear of the air intake casing. On the rear of the intake

gas low-speed shaft is the oil transfer shaft for operation of the de-bladed air intake propeller.

The structure, low-pressure compressor has a one-piece steel rotor casing, with blades made from light alloy forgings and all data in steel. Pressure ratio is approximately 3.5:1. Inlet guide vanes and first-stage stator are preheated hollow steel. Between the two compressors is an aluminum intermediate casing which carries the first wheel case for the external ducting. Also fitted here is a compressor bleed valve automatically operated by the engine.

The high-pressure compressor has four stages with blades manufactured in titanium and steel with one-piece outer casing and steel ducts. Pressure ratio is approximately 15:1, giving an overall pressure ratio of 150:1.

Combustion turbine comprises an annular hot gas turbine housing 10 in. diameter and 10 in. high. Turbine is fitted in each flame tube, together with high-speed igniter. The high-pressure turbine is a single-stage unit consisting of an axial turbine housing. Air for the cooling of the turbine ducts, turbine blades and turbine guide vanes is bled from the high-pressure compressor.

The low-pressure turbine is a three-stage unit consisting of several blades that is air cooling air supplied to all ducts. The first-stage duct and front face of the intermediate duct are cooled with high-pressure air and the remainder with low-

pressure air bled from the intermediate casing.

Hot-shield extends from the front of the combustion system to the rear of the turbine. The shield is made of a ceramic material, affecting reduction of the outer skin temperature of the engine. Most of the engine is covered by a ceramic material, incorporated in the first stage, low-pressure turbine guide casing.

Anti-icing

Engine is protected from ice in three ways: high-pressure air is bled from the rear of the high-pressure compressor and passed through the hollow inlet guide vanes and first stage stator of the low-pressure compressor and then directed outward or can be used for heating-into such as oil cooler anti-ice. Hot air is continuously in contact with the inner and outer walls of the air intake casing and ducts to prevent ice formation. Electrical heaters are fitted to all intake cone casing.

Low-pressure bleed air is supplied to all bearings except those which the reduction gear stages. This flow of air over all bearing housings provides for the cooling of the bearings. The pressure of this air maintains a pressure differential across the labyrinth seals, thus no physical contact between moving and stationary components to prevent oil seeping from the bearing chambers.

Main purpose of oil in these engines

length length of Air Force Missile Development Center, Ballistics AFTR, N. M. The shelter is designed to withstand an atomic blast.

Solid propellant rocket booster is shown falling away, fighter who was full-fledged power and acceleration.

is lubrication, as against cooling, since all bearing housings are surrounded by cooling air. Even bearing chamber is connected to a cooling system circulating through a centrifugal blower in the high-pressure compressor.

Engine Gearing

Engine gearing is as follows from the front end of the high-pressure compressor a drive shaft is taken out through the intermediate compressor casing to the high-pressure turbine, which provides the drive for all engine accessories, fuel pumps, oil pumps, turbocharger drive, centrifugal blower, etc. It also provides the input for the starter motor.

From the rear of the low-pressure compressor a second drive is taken to the low-pressure turbine. This casing provides the drive for the auxiliary gearbox for the auxiliary turbine, such as the starter motor and low-pressure turbine. As a safety feature, the drive for the propeller control unit is taken direct from the reduction gear, avoiding loss of propeller control should decoupling of the induction gear from the low-pressure shaft suddenly occur.

Control of the engine, in principle, is basically similar to that of the Dart, and relatively uncomplicated, the company states.

For ground operation, Rolls-Royce adopted the Beta system where control of engine speed is transferred from the

propeller governor to the intermediate shaft governor on the low-pressure shaft system. Response on both pumps and engine thrust is obtained by direct selection of propeller blade angle achieved by mechanical feedback linkage from the propeller hub to the gas pedal control unit.

In the Beta range, engine speed can be varied from 10,000 rpm at the zero main propeller blade angle, through 11,000 rpm at normal ground idle to 12,000 rpm at maximum propeller blade angle. Engine is 12,000 rpm in single alternate reverse thrust through out the entire landing run.

During normal ground idling engine speed is set to 11,000 rpm. To ensure fuel and reduce noise level in large ground idling position can be selected as the fuel control unit. Engine speed in this condition will fall to about 4,000 rpm and fuel flow will be at normal ground idling. Fuel will be reduced before normal throttle operation is permissible. Engine starting is carried out at low ground idle setting.

Rolls-Royce has made a design study of problems involved in adoption of an alternative propeller, of U.S. variable type, which requires that while there are major detail design changes necessary, there are no fundamental differences involved. Rolls-Royce followed is that as single failure within engine-propeller combination shall jeopardize safety of the aircraft.

Protective devices include: Mechanical right-side stop set to a value just below maximum blade angle required for idling on a hot day, an electrical/airflow right-side stop set 2 deg. lower than the mechanical stop; a bidirectional feathering system to operate in a falling off air pressure torque at high power settings and negative torque at low power settings; a mechanical pitch lock responsive to overpressure or loss of pressure in pitch-to-lock with a maximum blade angle movement of 2 deg. between engagement of mechanism.

Other protective device is a hydraulic pitch lock in event of loss of control pressure, the Beta control following stop, a bidirectional mechanical fuel governor on the high-pressure shaft as usually incorporated within the main fuel pump, a bidirectional over-speed fuel governor driven from the low-pressure turbine assembly, a fuel control device on the low-pressure shaft assembly as arranged that are failure of the low-pressure turbine shaft would automatically cut the fuel supply.

North American Support

Rolls-Royce of Canada, Ltd., Montreal (of which R. M. Kendall is general manager and a director), a wholly-owned subsidiary of the Derby, England, manufacturer, provides technical service, training, overhaul facilities, spare parts, service representation, etc., for customers.



Vertol's VTOL/STOL Aircraft

Built today... in preparation for tomorrow

Vertol achieved a major breakthrough in aircraft development during 1958, when its Model 76 (Army V6-1) became the world's first tilt-wing vertical take-off and landing (VTOL) research aircraft to successfully complete conversion flights. In extensive tests since the first conversion flight, this tilt-wing design concept has also shown its effectiveness as a short take-off and landing (STOL) aircraft. Because the Vertol tilt-wing design qualifies in this dual role as a VTOL/STOL vehicle, it has tremendous potential for both military and commercial aviation.

As a next step, Vertol can now build an operational type aircraft incorporating the tilt-wing principle, to explore more practically — through evaluation — the mission usefulness of any VTOL/STOL type aircraft.

In anti-submarine work, this versatile VTOL/STOL vehicle offers high forward speed plus the hovering characteristics necessary for effective completion of all phases of such missions, thus replacing — with one aircraft — the several different types currently required. The broad capabilities of the Vertol tilt-wing design also include application as an *airtruck*. In an *airsea* role, it can take off and land with substantially increased gross weights and payloads. This unique capacity, combined with VTOL performance, permits the user to "custom tailor" his take-offs to altitude, temperature, available runway and load.

This development of the tilt-wing is the latest example of the foresight and skill in research and development which Vertol has demonstrated over the past 15 years.

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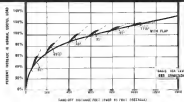
A tilting aircraft for operational evaluation of VTOL, STOL, *airsea* usefulness.



In anti-submarine warfare, the tilt-wing design offers fast forward speed and hovering ability.



In its dual role as an STOL aircraft, the tilting design could be utilized as a high load capacity *airtruck*.



Increase in Useful Load of Tilt-Wing VTOL when operated as STOL.

however, being modified to overcome wing-propeller interference effects. Thus, since when Polaris increased the propeller speed to improve its efficiency at this designed flight speed.

Power Output

Most members of MPAC consider that a man is capable of sustaining an output of one-third horsepower almost indefinitely and can make a one-hour power effort for about five minutes, providing he is fit. Polaris' average stall speed is expected to be about 28 mph and takeoff distance about 50-100 yards.

The centrifuge—designed by sculp-

tor and designer Fred Hartman—can largely criticize glider materials and construction but has flying wings hanging on ball bearings with flexible trailing edge members or "feathers".

Unique feature of the wing flying system is the sliding wing mechanism at wingroot where Hartman proposes to oscillate the wings in response with the elastic action and thereby obtain greater wing deflection for a given effort.

The 10 ft span wings are loaded to prove horizontal by the rubber bands passing the laterally opposed longer in the flying frame while the pilot extends and contracts to flip the wings. The outgager rubber bands joining the

bottom of the fuselage with the tail-wing are loaded to resist the downward action of the wing, but is low power. The pilot apparently activates the system into a state of resonance and sustains it.

The aircraft has no ailerons and it is believed Hartman expects to induce bank by varying the aspect. Hartman's objective is not to take off unaided but to be able to extend his glide and exploit thermals better. He claims the glider will be semi-autonomous.

Available Experience

Senior members of the MPAC indicated that while the centrifuge approach to autonomous flight was probably the most appropriate, it probably was more expensive to proceed with with a fixed wing aircraft because of the aerodynamic experience already available. There appeared to be a very strong feeling that a fixed, adjustable and structural investigation program of the centrifuge was justified. This was already being done in Russia although it was not thought in Britain that the Russians had yet demonstrated sustained flight. It is believed that the Russians, in investigating the technical feasibility and the speed and drag parameters with the aid of centrifuge powered by small engines.

According to David Rendell, the MPAC's first secretary and deputy superintendent of the national department of the Royal Aircraft Establishment, the centrifuge was probably the most satisfactory line of attack for a large number of reasons. He told Aviation Week that the centrifuge advantages are:

- Effectiveness at very low speeds, compared with a wing-propeller combination.
- Freezing action of the wings could be used to give boundary layer control.
- Variable wing geometry was easily obtained.
- Weight advantage.

Wing Twist

To be effective, the wing must not only flap, it also must twist about its span axis. A rigid wing which only flaps tends to develop a thrust when moving in one direction and no opposite thrust in the other. To maintain unidirectional thrust the wing must twist and contract as the wing flaps and rises. For maximum efficiency, the amount of twist must vary at different chord stations to suit the instantaneous position of the wing path through the air.

This is precisely what hands do, and Rendell maintained it had been analyzed on models using a rigid wing supporting an elastic spar. The trailing flexible surface moves out of phase with

the spar and so presents a twisted surface to the air.

The trailing "finger" or "feather" on Hartman's wing are, apparently, a compromise arrangement.

A most attractive feature, according to Rendell, is the boundary layer control with flapping wings which arises from the pumping action of the wing. Due to the changing pressure differential along the wing as the aerobically changes, boundary layer air can be moved from one wing surface to another by use of non return valves which reduce the wing drag.

Valve Action

Reels employ the same action, in effect using their feathers as non-return valves. It has been demonstrated that gluing some of a bird's wing feathers together inhibits this valve action and prevents it from developing sufficient lift.

Another advantage of the flapping system, Rendell said, now derive from the Hartman's aircraft, which is the build-up of induced drag is delayed when a wing is inflated. It possibly could be kept continuously inflated in a variable stage, he indicated.

Stock Transactions

Disposition of capital shares by some officers of North American Aviation has been reported by the Securities and Exchange Commission for the periods from July 11 to Aug. 10 and Aug. 11 to Sept. 10. S. C. Gough, officer, 100 shares, leaving a holding of 239, 1. L. Alvord, officer and director, 11,000 shares, leaving a holding of 5,793, Gerald B. Brough, officer and director, 2,000 shares, leaving a holding of 3,714, C. J. Culbert, officer and director, 1,400 shares, leaving a holding of 3,100, J. H. Kunkelberger, officer and director, 17,200 shares, leaving a holding of 21,717, R. A. Lambeth, officer and director, 1,200 shares, leaving a holding of 2,292, J. Marice, director, officer and director, 800 shares, leaving a holding of 1,316, Laurence L. Watt, officer, 700 shares, leaving a holding of 1,300, W. H. Yahn, officer, 100 shares, leaving a holding of 900.

Transactions for the periods July 11-Aug. 10 and Aug. 11-Sept. 10 include: Roy E. Anderson, Jr., director of Los Angeles Aircraft Co., 200 shares, leaving a holding of 1,000 common shares by John A. Hill, officer, leaving a holding of 1,000 common shares, leaving a holding of 1,000 common shares through purchase of 1,000 common shares from Los Angeles Aircraft Co., 200 shares, leaving a holding of 1,000.

Dallas Brains Aid Jet-Age Planning

To meet expanding air traffic requirements and increase flight safety, the Federal Aviation Agency is installing a network of microwave relay systems across the nation. These systems enable constant en route air traffic surveillance. For the design and installation of this huge network, the FAA turned to a Dallas firm... the Texas Division of the Collins Radio Company.



Left, typical microwave radio air way Dallas

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Brock Aircraft Corp. Acquisition of 100 common shares by John E. Brock, officer leasing a building of 1,000 disposition of 1,000 common shares by John E. Brock, officer leasing a building of 1,000

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A unique approach to problems of AUTOMATIC CHECKOUT and MONITORING

MSI—Monitor Systems Incorporated—is an autonomous subsidiary of Kipco, Incorporated... leader in the field of data control and a pioneer in the development and manufacture of automatic checkout and monitoring equipment. MSI offers technical talent of the highest caliber, backed by Kipco's long experience in this highly specialized field.

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MSI is an independent company with its own, entirely separate staff and facilities. It is not a department of a large corporation competing for operational resources with other departments. As a result, all the talent, all the research, design and productive effort are concentrated upon a single objective... the advancement of automatic checkout and monitoring systems technology for weapon systems and subsystems testing, aircraft pre-flight testing, nuclear reactor monitoring, process monitoring, component testing.

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MONITOR SYSTEMS INCORPORATED

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with stored program
speed and ability

Never before has so much powerful data processing ability been built into such low-cost systems! For in these two new IBM 1401 Systems you get features previously found only in the larger data processing systems. With 1401 Systems your machine runs so much faster... at higher speeds... with greater accuracy and reliability... at lower job cost.

To insure you of more production per data processing dollar, IBM's concept of Balanced Data Processing gives you non-pulsed input processing and output speeds backed by unequalled customer service. Drawing on all the experience gained in developing the world's largest and fastest computers, these low-cost 1401 Systems bring you these large computer features.

Self-Start Design—and streamlined throughput to give you a compact system with greater accuracy and reliability. This powerful system involves no special construction... no air conditioning.

Stored Program—gives you the fully automatic processing of electronic systems. It is the key to simplified economical operation. Completely flexible, a stored program permits you to switch easily from one type of job to another.

Magnetic Core Storage—the most powerful type storage available. To increase this power even further, the core memory of the 1401 stores variable-length data and instructions in terms of storage of only useful information. Choice of 1400, 3000, or 4000 positions in storage means you select the size storage to suit your needs.

High-Speed Printing—these 1401 systems feature an roller air jet concept of printing. A horizontally rotating drum gives high quality, perfectly aligned copy. A fast speed carriage permits printing at the rate of 800 lines a minute, skipping blank paper at 27,000 lines per minute to produce more documents per dollar. Completely flexible editing and proof format is provided by the control processor.

Your local IBM representative can explain the many applications and unusual features of the new 1401 Systems. Call today. These systems, like all IBM data processing systems, may be purchased on lease.

BALANCED DATA PROCESSING

IBM



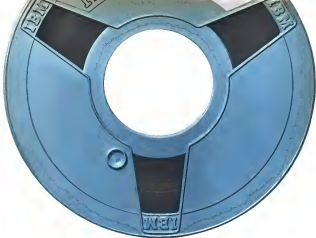
1401 CARD SYSTEMS

These stored program systems now bring the power of electronics to IBM card systems. They automatically handle the work of accounting machine: summary punch, and collation, but at far greater speed and with more flexibility and accuracy.

Input is faster—IBM cards are read into the system at the rate of 800 per minute. Data is processed automatically under stored program control. Manual card handling is minimized.

Output is faster—documents are printed at the rate of 800 lines per minute. Cards punched at 250 per minute. The system will turn out, for example, as many as 150 checks in one minute—again, more documents per dollar through Balanced Data Processing!

Throughput is faster—data flow is automatically checked for accuracy and speeded all along the line. A unique Card Read-Punch combines card input output and summary punching functions. Five reader stacks accept cards that are selectively rejected under stored program control.



1401 TAPE SYSTEMS

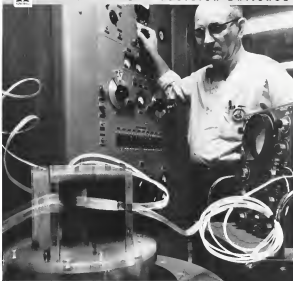
IBM 1401 Tape Systems give you added power through use of up to six magnetic tape units. These two feed data into the system at the rate of up to 51,000 characters per second—stored program reads at the same peak speed.

1401 Tape Systems are also extremely valuable as off-line auxiliaries to large data processing systems. They can edit tapes prepared for larger IBM systems. They make possible a tape-oriented IBM 7070 configuration on that provides higher speed input and output and makes for job-cost improvement.

When tape units are added to 1401 Systems you get greater flexibility and storage advantages too. IBM tapes provide extremely compact storage of variable-length records—the equivalent of 150,000 IBM cards in a single reel. Tape records can be of variable length, and are read into and out of the system automatically. Also, tapes can be erased and re-used to minimize your record-keeping costs.



MICRO SWITCH Precision Switches



WHY SWITCHES GET SHOOK UP

Designing precision switches for aircraft and missiles means the simultaneous problems of meeting specifications and having the laboratories and test equipment that prove performance. Take vibration, for example. To be valid, a vibration test like the one shown above



AN "EN" SWITCH

must simulate the frequency range and intensity of the particular vibrations the switch will encounter. And that is only the beginning for the switch. It must pass other qualifying tests that may include intense heat, subzero cold, extreme pressure, shock, radiation, and other conditions of high-speed, high-altitude flight.

Takes time? Costs money? Of course! But when you weigh the expense and effort devoted to testing against the importance of being sure, you know why these so-called "EN" switches (among others) are shaken up and battered, but good. . . why the micro switch is synonymous with dependability and precision in airborne switches.

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Honeywell

MICRO SWITCH Precision Switches



REFRACTORY MATERIAL FORGINGS FOR 5000° F TEMPERATURES

Cameron forgings have solved many a design problem, but this is one of which we are particularly proud. Nozzle throats in solid propellant missiles must control the dynamic temperatures which make high performance possible. All the push comes through this part and temperatures range over 5000° F almost instantly, but the throat must most maintain its shape for peak burnout conditions. Just to complicate matters, the exotic alloys specified for these important parts are extremely brittle and expensive. In forming and machining the costly metal every ounce is important—with conventional processes forging makes matters worse.



When Cameron's unique forging methods were applied to this refractory situation, some interesting things happened. Our years of experience in forging high stress, high temperature components helped change the picture completely. Less material was required because our specially designed presses could forge to a near-final shape. Moreover the ductility of these tricky alloys was increased, making them easier to handle and machine. As a result, we are now turning out quite a variety of our advanced forgings for nozzle throats to help give missiles the proper push. Cameron forgings have opened

many possibilities in advanced designs today. Extreme service components for satellites, jet engines, guided missiles, nuclear power plants, and a wide range of other end uses are being forged by the Cameron spiritlike and down-acting process.

If your design problem involves high stresses, high temperatures, or large, intricately shaped ferrous parts, maybe we can help. Just call, write, or come by . . .



REFRACTORY MATERIALS: Molybdenum • Tungsten • Tantalum • Moly Tungsten • Tantalum Tungsten and others



RUNNING INTERFERENCE FOR SAC

Now SAC's B-57D has a pair of hand-running teammates... the GAM 77 Hawk Dog air-to-surface missiles. They can range into orbit at supersonic speeds to clear a path for the bomber by knocking out ground-defense centers hundreds of miles away. A pair of Hawk Dogs carried under the wings of the B-57D increases the bomber's strike power... gives it a triple-punch capability. Successful test launches of the jet-powered missiles are being made on schedule over the Atlantic missile range. The system will be deployed by 1960 under the present accelerated development program.

The Missile Division of North American Aviation is weapon system contractor for the GAM-77.

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new station, leaving a holding of 100 common shares in 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 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Cessna Predicts Doubled Sales Volume



RECORDED BY now more than 150 Model 210 and 172 planes were made at Wichita, Kan.



LANDING gear height on Model 175A and Skylark has been reduced about 18 in.



MODEL 210, featuring retractable gear, will be shown to the public in January.

Wichita, Kan.—Forecast of a "fabulous" growth by Cessna Aircraft Co. which envisions doubling the business and utility plane manufacturer's overall volume in the next five years and doubling it again in the following five years was made here by Donnie L. Wallace, company president.

The company's total sales for fiscal 1959 were approximately \$106,500,000, an all-time record and an increase of more than \$14,500,000 over fiscal 1958. Cessna's aircraft sales were up about \$5.4 million over fiscal 1958 and its engine products increased about \$4.1 million. Civil aviation volume declined as was expected.

Speaking to approximately 1,000 members of Cessna's domestic and international sales organization at the unveiling of the company's 1960 line, which Wallace said signaled the start of the "steering effort" for Cessna, he explained that this prediction of rapid continued growth should not be too difficult to attain because it is based on a platform or springboard, considerably stronger than was available in any comparable period in the firm's history.

This platform consists of a larger, growth more experienced distributorship organization financially stronger and backed by a mortgage better engineered and with greater resources than ever before in its history, he said. To quash any doubts as to the ability of the sales force to meet the goals he set before them, Wallace pointed out that five years ago, Cessna set up an objective of a 10% growth increase each year and that actual growth shot over this target by showing an increase of approximately 16% annually, for a jump in the five year period, 1955-1959, of some 117%.

Export Business

Speaking to also representatives from foreign countries, Del Runkles, vice president aircraft division, went one step further in pointing out the increased business he had he expected Cessna will develop abroad. Runkles said he confidently expected that the company's export business should triple over current volume in the next five years. Highlighting past increases in foreign business, Cessna Marketing Manager Fred Martin told overseas representatives that in fiscal 1959 the company expected more airplanes than its total sales increased in just 10 years ago.

Impact of this forecasted growth on Cessna's past should be of more consequence on even phase of general

operation in the next decade. As Wallace candidly pointed out, this opportunity that exist for Cessna are also available in large measure, to its competitors, indicating that not only other airplane manufacturers, but all phases of business and utility aircraft design, including airport operations equipment sales, truck and lubricants business will be tied to the sharply declining price of the domestic phase of aviation.

Radiation are, too, that those who do not gear their thinking and operations to staying with this curve will fall behind and be overtaken—perhaps permanently by more aggressive competitors. This relationship of opportunity to manufacturers was sharply pointed up in discussions here with distributors and dealers, many of whom have recently completed or are embarking on expansion programs of their facilities to keep up with anticipated sales service needs.

Dealer Construction

Individual programs on the part of Cessna distributors and dealers are aggregating millions of dollars of new construction and equipment to facilitate sales and service—in the past year a number of the company's outlets have expended their funds at cost ranging from \$300,000-\$500,000.

Dealers volume has grown to the point that distributorship wholesaling is big enough to support itself and the manufacturer has been urging distributors with such volume to set up their wholesaling operations as a separate company with its own management, business and records to handle their most efficiently.

In support of distributor-dealer efforts, the company will increase its promotion and advertising expenditures by approximately one-third for a total of about \$1 million in fiscal 1960. More than 12 million pieces of sales literature have been printed for distribution in the coming year, compared with approximately 1.5 million printed and distributed in 1957. In a new approach to the foreign market, Cessna advertising abroad will actually be aimed at government officials rather than consumer prospects—the decision emphasizing the contribution business and utility aircraft can make to the country's economy. The company hopes this method will serve to educate civil officials on the benefits that such imports can provide as opposed to their thinking of restrictions because of dollar "shortages."

A further program to spur sales is a new plan developed by Cessna's wholly-owned subsidiary, National Aero Finance Co., with which the manufacturer is offering retail aircraft sales financing to provide its sales outlets with greater facilities in handling new

BUSINESS FLYING



SKYLARK Model 175A swept tail is a feature of all new Cessna models except 110 and 160.



ADDITIONAL air window on 260 Model improves cabin visibility.



CESSNA Model 172, approved for flight by first time, features new McCauley propeller.

Why Lockheed's all-purpose AGENA is America's most versatile satellite



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First to be put in a polar orbit. Only the Agena, with its keep-alive booster and its response to commands from Earth, can be placed in a precise, predesigned orbit over the pole.



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FOR THE UNITED STATES AIR FORCE

WHAT IT DOES: This unit is incorporated in the U.S. Air Force AF-119S-20 Infrared Search System, at which Aero-Com is the Prime Contractor to the Air National Guard's Rome Air Military Base — Griffis Air Force Base, New York. The antenna and pedestal will stand three stories high and be housed in a dome about 50 feet in diameter.

The assembly is composed of a plastic disc 48" in diameter and 1/4" thick mounted on a cast aluminum housing. The 62 signal slip ring disc is cast of highly filled epoxy resin and is the largest single-piece "pancake" slip ring ever manufactured using the electro-deposition process.

Five aluminum brush blocks are provided in three groups of three blocks each, spaced 120° apart. The brush blocks are mounted on a solid cast aluminum housing. Outstanding performance has been verified by operational tests.

Using actual unique stress, function, and stability problems involved in gases, metal surfaces, substrates, order, and assembly, they have solved with Electro Tec slip rings—exactly as well as possible.

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aircraft sales and providing customers with "one stop" service. Under the plan, a customer can buy a 1950 Cessna with a 25% down payment and arrange monthly payments over three years for single-engine aircraft and four years for two-engine equipment. Expected to be in operation by Dec. 1, new plans will have interest rates "in line with other major consumer" — approximately 6% for single-engine types and 8% for two-engine. Vice President/Treasurer Frank A. Bechtler told AVIATION WEEK, The subsidiary will also make available a full insurance plan as part of the retail financing package. The new plan will supplement previous plans which National Aero developed to enable dealers to stock demonstrations on 6-12-24-month guarantee basis without charging capital funds. It is expected to increase the financing company's turnover by a substantial volume, particularly in areas where a tight money situation has driven customers to the point where banks might not be able to handle requests for the retail financing loans.

In the past year, National Aero's inventory approximately one-third of the 350 demonstrations that left the plant after the sales meeting here, some 90% were financed by the subsidiary. In fiscal 1959, National Aero's receivables totaled some \$7 million during peak periods. Max Turner was the largest at Cessna's factory, with retail value of the 350 airplanes delivered being estimated at well over \$5.5 million, compared with the previous year, March, 1958, of 215 airplanes flown into sales at \$5,750,000. This mass flow, together with other deliveries in October, which were expected to total approximately 440 airplanes, will probably provide the company with its biggest single month of dollar volume in its history.

Airplanes were flown by distributors and dealers to home bases for use as demonstrators and completed Model 150 and 172, first of company's 1960 "line of new" models. The large number of sales representatives present pointed up heavy emphasis Cessna has put on expanding its network in recent years. In 1956 it had approximately 175 retail outlets in the United States alone, now it has 305 and is still expanding the phase of the retail operation.

An interesting trend has been the company's move of automobile dealers to check their interest in becoming Cessna dealers on certain areas where it feels air outlets are desirable. It is coming in the list of outlets for those car dealers who recently parallel the philosophies in market penetration and reports that company has been favorable. Programs developed in past years

were presented to foreign sales representatives, pointing out that they stand a chance of developing their own business while helping the subsidiaries learned the hard way by domestic dealers in other areas. Most of the export representatives that in the 1950s Cessna wants to cover the world with whole-line distributors in dealer territories. To support known with foreign outlets, the company has been developing a staff of 100 line salesmen for foreign areas who will spend at least half their time in their own territories.

Export Manager M. F. McFarlane urged foreign dealers to promote general aviation in all of their areas. "The big government order is now," he said, "but effort must be made to build and business for the long haul and greater future business." Dealers should also develop cooperation between each other in various countries for mutual building of civil aviation that will benefit all.

McFarlane pointed out that in the United States, if dealers develop business well as one unit, this helps dealers in adjusting orders and developing new facilities in one area helps all areas since it increases living and encourages one of growth.

Management Program

Initiation of further expansion in foreign areas was provided by Roskum who noted that the management development program at Cessna has found President Dwight Wallace from many day-to-day chores and he will have more time to study the "big picture" for future planning. Roskum noted that this year he and Wallace will be traveling most, high on the agenda are two planned to study possibilities of setting up Cessna plants overseas to serve the market more adequately.

These plants might initially start out as assembly facilities for parts shipped from the U.S. and would phase into more into local production as demand increases. A major benefit of such installations also would provide stockpiles of spare parts for foreign distributors and dealers, which would cut out of their service customer service letters, but would also provide an important sales point in talking to prospects.

The new line for 1960 shown during the distributor dealer meeting included eight of nine airplanes Cessna will offer in the coming year—the largest line in its history. The main airplane will be the Cessna 310D, to be shown in January.

Used at providing "total coverage," the new line features numerous improvements over last year's models. The most noteworthy change is rotor position on all aircraft, except the Model 150 and 180 single aircraft, of swept tips.

The new design obviously makes all

previous airplanes obsolete, in style, although it also serves to improve air plane aerodynamic and main balance by moving the fuselage moment arm rearward some 24 in. Tail is swept 37 deg. Features of 1960 line include:

The last package version of the Model 175A, called the Skylark, is being marketed for the first time. Like its lower priced companion, the airplane will be equipped at dealer's option with the controls in each December. Skylark will feature package pricing for factory-installed equipment, previously optional on the Model 175A main electronics, at \$13,000 luxury features. Model 175A, with standard equipment

will be priced at \$11,600. Skylark equipment package includes horizon and directional gyros, engine-driven vacuum system, turn-and-bank indicator, radio-compass indicator, sensitive altimeter, outside air temperature gauge, clock, ice cream, landing and taxi lights, three-color paint combination, aviation light fuselage, low bar, vibration wheel speed fittings and wing strut fitting.

Both Skylark and 175A are approved on Cessna's. Airplanes are constructed at a 100-lb gross weight increase over last year. Landing gear on these airplanes has been shortened 74 in. to lower the airplane and increase stability.

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with wide band sole tuning

Though it has just recently made its debut into the high society of Litton microwave tubes, this carcinotron (our model L-3256) has already been commended by the military for its exceptionally clean design. Every engineer concerned with optimizing the performance of ECM equipment will surely find much of interest in this modern power tube, with which Litton takes a major stride toward truly instantaneous noise-tuning capability by affording faster tuning rates than any previously attainable.

The Litton family of eight electrically compatible carcinotrons is the first to incorporate the critical capability of wide band sole tuning without frequency or power holes when the tube is operated into as much as a 1.5-sec-1.5-millisecond RF output envelope, maintaining many system components such as antennas, waveguide plumbing, and load isolators.

We cite these facts not for glory's sake, but rather for their meaningful contribution to more efficient system design, smaller size and lighter weight.



The notable suitability of these carcinotrons is not limited to ECM. You can also consider them for other military applications such as drivers for communications links—in fact, wherever cathode-powered tubes with extremely rapid tuning and low tuning power are required. Because of their mechanical and electrical compatibility the eight tubes in the family are interchangeable, as shown.



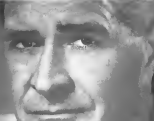
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CAPABILITY THAT CAN CHANGE YOUR PLANNING



since over last year's version, top speed at sea level is 140 mph, maximum recommended cruise at 70% power at 5,000 ft is 131 mph, cruise range has been extended from 410 mi to 545 mi, and maximum range is upped from 745 mi to 790 mi. Service ceiling has been increased from 13,300 ft to 15,000 ft, while rate of climb is up from 650 fpm to 770 fpm. Flightplace version has a gross weight of 2,220 lb compared with the baseline's 2,300 lb, and has a maximum speed of 104 mph, and maximum recommended cruise speed at 70% power at 5,000 ft of 101 mph. Fuelburn rate of climb is 560 fpm.

Model 210, which has retractable tricycle landing gear, will be shown at dealer facilities in January. The price is \$12,450 for a standard-equipped airplane. Most delivery models probably will cost an average of \$24,000, says the company.

Features of this new airplane were detailed in an Aviation Week report last year (AW Aug. 31 p. 45).

Model 150 Equipment

Two-place Model 150 housing and rthly airplane will have burst panel and still warning indicator as standard. A 17-amp generator is being offered as standard equipment on the "military converted" version, but will be optional on other models. Trainer model will have an standard a choice of radio including the Narco Spectraform, Wright 60, and dog-in an export configuration, the Seneca.

The airplane is now available for patrol work and can be converted or packaged from the factory with "patrol" wings, door and message chair. Patrol wings carry 35 gal of fuel as each wing with a total usable fuel of 35 gal as compared with 22.5 gal usable in the other models. This increases maximum range from 610 mi to 980 mi. Patrol doors have a large flight panel for the lower fuselage to provide increased downward visibility.

Message chair is located on the left side in front of the pilot's seat. Patrol wings are available for \$112.50 on a meter-exchange basis, patrol doors are available at \$105 exchange price and the message chair can be added for \$150. Price for the standard Model 150 is \$7,193 for the basic kit, it is \$8,193 and for the meter-exchange version, \$8,795.

Cessna's 1960 line will be given public showings at dealers around the country on the following schedule for the various models:
• Models 150 and 172—early December
• Models 175A and Skylark—early December
• Models 210, Skylark, 182 and 180—January

Molded Harnesses for Missiles



Powered by the latest engine produced by the Houston Motors Division of Truax Chemical Corporation, the North American X-15—the first manned space vehicle—will exceed speeds of 3600 mph and will penetrate more than 100 miles into space. Reverse Molded Harnesses, developed in conjunction with Reaction Motors' engineers, will supply the vital electrical interconnections for this mighty powerplant.

1. Continuous operation from -70°F to +275°F
2. Ten minute operation at +100°F without damage
3. Protection against the occurrence of corona, operation at 100,000 feet without corona
4. Environmental protection against H₂O, hydrocarbon ammonia, liquid oxygen and 100% humidity

Harnesses for the X-15 engine are another example of the many types of specially designed Reverse Harnesses. Electrical interconnections for carburetors and ground applications, thermocouple harnesses for heat measurement, molded harnesses for complete environmental protection—all are custom designed to meet specific requirements.

CALL ON REVERE... WHEN YOUR PROJECT DEMANDS THE BEST RATHER THAN "OFF-THE-SHELF" TREATMENT when you need engineering abilities and specialized facilities in the fields of:

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Temperature -	Operating - -50°F to +140°F
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Vibration	23 g's per cycle per second, 20-2000 cps random 5 minutes each on 2 axes
Shock	150g, 10 miliseconds, 60 direction 40g for 2 seconds on 3 directions
Acceleration	1400 hours guaranteed, 500 hours as tested
Service Free Life	1000 hours in 1000 volts d.c.
Insulation Resistance	100 Megohms at 500 volts d.c.
50 Periodic Test	200 mils, 40 cycles e.c. 3 min. each lead to ground

Complete specifications and drawings available
on request. Bulletin No. 506093

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PRIVATE LINES

Federal Aviation Agency is making spot checks of gross loadings of business aircraft to prevent accidents caused by overloading.

Second production model of Tempra II, B-26 conversion to negative configuration, has been ordered by General Mills Inc., Minneapolis. Tempra II is in production (AW Aug. 26, p. 131) by L. B. Smith Aircraft Corp. at Miami.

Seminate sales activity of William C. Wolf Associates, multi-engine aircraft broker, has topped \$1 million, the company and Sales ranged from a Beechcraft E185 to a Cessna 440 to a Cessna 440 to a Cessna 440 to a Cessna 440.

Continuation for "See and Be Seen" Seminate woodhills for installation on Douglas DC 3 and Lockheed Model 18 aircraft, has been ordered by Suncoast Corp., Burbank, Calif., by Federal Aviation Agency. Systems include very thin metalized coating on outer surface of laminated plastic on fuselage glass heat from electric current is used for anti-icing and de-icing.

Merlin 4-4 executive conversion has been delivered to Keston 001 Co., Philadelphia, Pa., by Research-Warner, Inc. St. Louis. Designed to seat 16 passengers, the airplane is equipped with Bendix K1000 weather radar, Sperry SP-20 autopilot, dual Collins VFR omni, dual Collins VIF glide-slope receiver and dual radio magnetic indicator. Radio M455 marker. Collins VIF-20R and Autocoll Radio Corp. 210 VIF communications. Collins 104-A transceiver and radio telephone and dual AXC Type 21 ADF receiver. 2,400 hp Pratt & Whitney Aircraft R-2600 CR16 engines. The Keston 4-4 will be based at Merritt Center Airport, Trenton, N. J.

Fast permanent flight was made recently by new Howard 500 Ventura business transport conversion, with airplane maintaining sea level cabin atmosphere while at 16,000 ft and equivalent of 3,000 ft while at 21,000 ft. At latter height, Howard 500 showed true airspeed of 555 mph during the 1 hr 23 min. aerial flight. Airplane, which incorporates a completely new fuselage designed to meet latest Federal Aviation Agency Part 440 requirements, is reported capable of maintaining cabin pressure of 2,900 ft and true airspeed at 550 mph at 20,000 ft. Designed to seat 12-14 passengers, the airplane is powered by two Pratt & Whitney R-2800s.

NEW AVIATION PRODUCTS

Rocket Rate Gyro

Rate gyro for high altitude rocket research measures 1 1/2 in. in diameter and 1 1/2 in. long. Gyro has a d.c. motor and a potentiometer pickup.

Model 4624-B101 gyro will operate in a temperature range from -65 to +100°F, to unlimited altitude, 10 to 2,000 cps and 10g acceleration. The motor runs on 25 v. d.c., 150 a. maximum rating current. The unit is suitable for any rate gyro application. Hughes Inc., 2505 Conant St., San Diego 6, Calif.



Torsion Springs

Torsion coil rubber springs for the Arm Hawk missile launcher weigh 16 lb. each. Two springs on the launcher support 5,200 lb. Springs, comprising two concentric metal rings bonded to rubber, have a deflection of 0 to 42 deg. Each spring is 5 1/2 in. long and 7 1/2 in. in diameter. B. F. Goodrich Industrial Products Co., Akron, Ohio.



Bending Meter

Model T707 Michren Bridge bend-

ing meter is designed to provide a safe method of measuring low resistance in "batter" areas on and around aircraft fuel tanks and fuel cells without danger of explosion. Unit has a range of 1 microhm to 1 ohm and is a self-contained a.c. resistance bridge, operating power is from pack of flashlight battery cells.

Avionics Manufacturing Co., Inc., 10409 Meach Ave., Cleveland 5, Ohio.



Anti-Overrun Valve

Hydraulic valve in use on the Thor intermediate range ballistic missile reactor regulates fuel flow through all phases of missile operation. The valve overcomes the problem of an overrunning load as the center of gravity of the missile passes the actual pivoting point.

The valve consists of a metering type, weighting flow control that is pressure compensated for a fixed pressure differential. An integral motor-actuated four-way directional control regulates

stops and starts in mid-cycle. Output can be controlled mechanically, electrically, or hydraulically.

Vickers Inc., Marine and Ordnance Dept., 172 E. Aurora St., Watertown, Conn.



Fuel Flowmeter

New flowmeters for measuring fuel flow on business aircraft, small jet and helicopter weigh 2 lb. Normal range of the meters is up to 1,200 gph. Overload conditions for ratings up to 1,500 to 2,000 gph, are available. Power requirements for the system are 115 v., 400 cps.

Temperature range is from -65 to +250°F. True mass rate of flow is indicated by an illustrated pointer or an integrally lighter dial scale. Unlighted version of the indicator also is available.



Transport Aircraft Tow Tractor

Transport aircraft tow tractor has a 30,000 lb. drawbar pull and will tow aircraft in groups of up to 10 mph. The vehicle has an 80 in. wheelbase and utilizes two-wheel, front steering, four-wheel steering and "road" (steering). Power for the two or four wheel drive tractor is provided by a 267 hp. Ford V-8 engine. The manufacturer is Clark Equipment Co., Rte. 6, Clark, Mich.

ANNOUNCING AVIATION WEEK'S
5th ANNUAL

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Day after day, engineering-management people review AVIATION WEEK'S ANNUAL BUYERS' GUIDE in their search for new sources of supply for products, materials and services. AVIATION WEEK'S BUYERS' GUIDE is the industry's preeminent buyers' guide covering all segments of the \$11 billion aviation industry and its related technologies.

The new 1968 edition is more complete, more up-to-date, more essential than ever before because it provides expanded listings on new products and companies in the new areas of the total market. It will contain over 50,000 manufacturers' product listings divided into over 1,800 specific product categories. In addition to being quick and easy to use, the BUYERS' GUIDE includes complete listings of government procurement agencies telling "Where to go; Who to see; What they buy."

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- 44% referred to it once a month or oftener
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Including Space Technology

General Electric Co., Boston
Dept., West Lynn, Mass.



Army Studies Sperry Navigation System

Great Neck, N. Y.—New lightweight, integrated doppler/dual okenoag navigation system and flight instrumentation has been developed by Sperry Gyroscope Co. for use in Army aircraft and helicopters. Prototype of the new AN/APN-118 system is now undergoing flight tests aboard a Douglas R-4D popanator to delivery to the Army Signal Corps.

The 120 lb system, fully transpondered except for two altimeters in the duplicate set, will give pilot his present position as well as required heading and the distance to two preselected targets and his home base. System

completely self-contained and does not require use of ground-based radio aids. Systems can operate as a pure dead reckoning navigators, using wind velocity and direction established previously by the doppler radar, in the event that pilot wishes to maintain radar silence in the vicinity of the coast.

The Spruce APN-118 includes the following flight-indicating instruments:

- **Map display:** Argyle's present position and heading are shown on a trackball square map display, with a moving pointer projected onto an acoustical chart or grid map.

*Altitude, rate of climb Vertical monograph type indicator is provided to display both barometric altitude and rate of climb as well as height above terrain, which is obtained from the doppler radar.

• **Groundspeed:** Another moving-tape display shows the airplane ground speed, as determined by the Doppler radar. Spectra says it plans to add an ATIS indicator which will give pilot the computed time of arrival to his target.

• **Altitude:** According to these announcements, the ATIS will also include a groundspeed indicator which some of the flight directors to show the pilot what changes in altitude, attitude or heading are required to reach target or destination. One instrument displays airplane attitude data using two cross pointers, the other shows airplane position, course, ground speed, and distance. Spectra says that "in a relatively small aircraft, Spectra has a lot of information to feed the pilot, so we're combining both the heading and attitude displays."

The AN-115 uses a gross stabilized doppler radar sensor (antenna) which was developed by Redstone, Inc., Melbourne, Fla. By using a stabilized doppler sensor and direct pulse-counting techniques to determine groundspeed, wind direction and velocity from the radar signal returns, Sperry has eliminated the need for a separate navigation computer. The pulse values received from the radar, after being divided down by a suitable factor, are used directly to drive stepping motors in the chart display and in the panel meter.

The APN-118 was developed under the sponsorship of the Army Signal Research and Development Laboratory, Ft. Monmouth, N. J.

Kansas University to Get

Trips Nuclear Reactor

General Dynamics Corp. will install a Trips Mk. 2 nuclear reactor at Kansas State University to further studies in engineering and industrial uses of atomic energy. Unit is above ground and can move from 1 watt of power to 1.5 million in less than 10 sec.

SAFETY

CAB Accident Investigation Report:

Piper Crash Blamed on C-124 Turbulence

A Piper Apache, owned and piloted by William Wilson Miller, age 31, crashed following structural failure near Dover, Del., on Sept. 25, 1983, about 1400 EST. The pilot, the sole occupant, was killed.

Miller was on route from Long Island N. Y., to Charlottesville, Va. While en route he believed to be about 1,000 ft. and during excellent weather, the aircraft was subjected to aerodynamic overload causing failure of the piston structure.

cent years is believed to have occurred, Sept. 25, 1955. At the time the investigation of accidents in U.S. civil aircraft weighs less than 12,500 lb had been delegated to the administrators of Civil Aeronautics by the Civil Aeronautics Board. Accordingly, the CAA performed an investigation; however, no final report or finding of probable cause was issued. On Dec. 22, 1955, the estate of the deceased pilot petitioned the Civil Aeronautics Board in Docket No. 16895 to investigate this accident and to make public its findings. The petition was granted and the following is the pertinent part of the description of the accident in Page 1 of NTSB's on May 30, 1959:

INVESTIGATION

Miles took off at N 2040Z, a Piper PA-22 aircraft, from John J. Appel, Leesville, N. Y., in 1987, for Charlottesville, Va., where he was a law student at the time. He was flying at 10,000 ft. and had roughly 100 mi. to go when he had engine trouble. He flew about 100 mi. at 175 mph, and weather over the entire route was mild for visual flight. The specific gross weight of the aircraft could not be determined, however, so it is clear there is a margin from the maximum permissible and that the center of gravity of the aircraft was located within limits. This model aircraft was placarded against aerobically engaging spins. Mr. Miles said he had some basic and no experience with spins.

No second route of the kind of my flight plan. No one at the airport or diagnostic could recall the kind of a flight plan although the flight planning of the route was automated. It was to be south from New York, east of McGuire AFB, and then by Victor airways to Charlotte, Va. Victor 16 serves a nearly straight line the Cape VOR, about 50 mi. south east of New York to the Chesapeake VOR, 13 mi. east of the University of Virginia Airport, the destination. The accident site is on this route.

Mr. Miller had a reputation for playing his rights carefully and most probably chose to attend in consideration of the work.

These were light and variable offering the most help at an altitude of 2,000 ft. and most of the route, including the approaches. This is based upon the winds aloft information for the Philadelphia area which offer most probable easterlies above 1,000 ft. It would have had to fly in accordance with the unimpaired provisions of the air traffic rules which would have made it necessary to fly at 2,500 or 3,000 ft. or higher. It is customary for pilots of jet aircraft to fly under 1,000 ft. in good weather over such flat and relatively open country. Thus, it is likely that the pilot was flying at approximately 2,000 ft.

The reported case rate in rats was 3 in 14 men, making a prevalence of about 113 mg/m³ for the 150 m³ from Zaka's report to the Kanton VGR, about one mile north of the crash site, is approximately 165 mg. As the accident occurred about 1 h to 20 min after takeoff, the prevalence was calculated to be about 118 mg/m³. He must have been sampling by the Kanton VGR as his name appears on a faded tassel to that frequency. Major parts of the aircraft were found within 100 yd of the wreckage. This also indicates that the aircraft was relatively low at the time of disintegration.

A nearby south of the accident area called only the law enforcement. One has immediately called police, establishing the time of the accident at 1400. All had seen the aircraft falling and crashing just after some had heard a loud noise. None had seen the aircraft prior to that time.

Safety Message for Pilots

It is unfortunately that workers are unable. If they could be so, they would look like a pair of horizontal lines, stretching back from each wing tip. For miles across their compact and interlocking air masses are close together and not well sometimes exhibiting lights, as a pin. They gradually weaken and the last one remains dimly visible and their brightness is lost of sight. Because the last hazard can be many miles across and since it is not thick and solid, the possibility of coming into this enormous danger by chance is extremely small. However, the

The intensity of the vortex is directly related to spin loading and inversely related to stagger, however, it is a safe and practical generalisation that the bigger the ship the more violent and long lived will be the vortex disturbance. Technically, the faster the plane is moving the less energy it costs off. The more it weighs in relation to its span, the greater will be its loading danger. Also, the *Wasser* (the loach) held on passing a vortex depends on the speed of entry. At half the speed the shock would be only one-fourth as great.

Don't you close behind me either, until, the bigger it is the more time it should be given. Two minutes should suffice in a working rule. Avoid, when possible, places and situations frequented by large groups. Avoid very high density airports, whether civil or military, should always be suspect. If you see a post behind a rising aircraft, change altitude so that you will be at least 100 ft higher or lower, preferably higher, and show them. If you do get into a bad corner, your best procedure is to ignore altitude changes and use no elevator control.

—Attachment to accompanying CAB accident investigation report.

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ed, and aerodynamic test data. Its own design covers the following:

"Positive load factor" higher than the maximum ultimate design requirements for Normal Category aircraft; aircraft can reasonably be expected.

In summary, all tests and theory in data indicate that structural failure can be, as required in light aircraft upon penetration of the vertical tail by larger and stronger and stiffer aircraft.

The variations and overalls of factors as mentioned when factoring a pair of factors in of great aerodynamic interest. The factors are both large and small.

When an airplane must squeeze through a pair of corners at San Francisco the loads imposed are up, down, and up, in that order. The total distance from entering one corner to leaving is made as short and would be traversed in a 170 mph airplane in less than two seconds. The total abrupt and positive) up current might actually be met by down elevator. Thus within a fraction of a second a sharp reversal of load occurs, then again in the next few seconds, another reversal.

Force Intensified

Most aircraft during the short period can only be assumed that if the elevator can pull over several degrees upon leaving the first up draft, as a right hand, the following forces would be greatly intensified. This condition, under these conditions, can be enough to destroy and aircraft which are designed to accept standards in normal category aircraft.

The Piper PA-12 is certified under Part 1 of the Civil Air Regulations. It is designed to an ultimate load factor of 5.75; and in compliance with Part 1 has a negative ultimate maneuvering load factor of 2.2g. This model aircraft has not been tested for duration and the actual negative load factor of all components has not been determined.

Furthermore, investigation shows that the loads that could be encountered at the rate of a large aircraft such as the C-119 as at a moderate rate approaching the load maneuvering load factor, positive and negative, and under certain conditions may reach or exceed the negative ultimate maneuvering load factor of Normal Category aircraft. These certain conditions include any appreciable strength by a pilot to hold constant altitude upon encountering the vortex.

CONCLUSION

The Board concludes that Miller was cruising on course at an altitude of 2,800 ft or less in the vicinity of the Kirtland VOR, that a large aircraft, probable a C-119, was leaving or approaching Davis VOR, crossing the Kirtland VOR, that Miller was or was not here upon the accident that if he had, being subjected with the potentially destructive forces of vortex turbulence, he may well have concluded his flying must be well below it, that the pilot of the other aircraft did not see the Piper or any of its apparently safe design, that the Piper sustained a wing tip vortex of the large aircraft and was destroyed.

The Board determines that the probable



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view of the accident was structural failure of a Piper PA22 aircraft resulting from excessive airspeed caused by wing tip vortices behind a large aircraft.

By the C-130
JOHN R. DEWEY
CHAS. CHERRY
HAROLD D. BOWEN
G. JAMES WATSON

SUPPLEMENTAL DATA

When Wilton Miller, age 31, held a solid pilot certificate with a single engine land airplane rating issued May 1, 1976, he had a total flying time of 316 hr. of which 152 hr. had been in the make and model. It would be an pilot of the time of his death. Miller held a valid Class II medical certificate, issued Sept. 15, 1975, with a requirement that he not exceeding 100 hrs. while piloting.

The aircraft was a Piper PA22-150, serial number 213214, N 24697. The aircraft was a two-engine model C-130, serial number 108735.

The aircraft was sold new to the state of Arizona by a dealer at Newland, Minn., in August 1971. Miller purchased the aircraft from the dealer and obtained a certificate of registration for it dated Dec. 21, 1975.

The last Visual Flight and Inspection Report dated that a possible inspection had been made on June 5, 1976. At that time the aircraft was found airworthy and its total time was 275 hr. Records reflect that all maintenance functions had been completed with. There also indicate that the aircraft had been properly maintained.

**Aircraft Need Cited
For Radiation Check**

Dallas, Tex.—Not one wheel or one person will be able to move with safety the remaining following a nuclear attack on the United States until the U.S. determines the extent of radiation levels existing across the country, among heavy members of freewheeling and returning aircraft equipped with detection gear, from Civil Defense chief Vol Peterson said here.

Peterson indicated that the large numbers of civil aircraft available should be incorporated into a civil defense plan for local authorities in these defense plan in an emergency. He said, however, that he had found considerable apathy among the aviation, as well as in civilian levels, for such an operation—feeling being that following an attack the U.S. will continue "business as usual."

To cover the situation he described, Peterson suggested that, initially, fast freewheeling aircraft be used to cover as wide an area as possible with their radiation detection equipment to provide a quick, on-call picture of danger. Radar wing aircraft could then provide more detailed readings to EE in the "radiation map."

On the basis of experience with nuclear disasters suffered here, Peterson

said the first requirement is to go in fast and heavy with actual equipment to eliminate suffering and provide rescue and safety about the cost of counting and bookkeeping later. The U.S. should learn to use aircraft more intelligently than we have thus far in the world, Peterson added that there has been considerable experience in using jets in disaster by use of aircraft primarily in saving of important businesses and other forces of nature in the case of a nuclear explosion. He said that one of the biggest problems has been in providing people to leave their homes. Lack of sufficient warning and resistance of people to leave a disaster-stricken area was noted as a major cause for loss of approximately 100 lives in an area of more 50 sq mi in California in 1957, which was struck by a mild wave.

**Seattle Airport Unit
Sets Operator Rules**

Plastic, free and student pilots may be discouraged from operating in and out of Seattle-Tacoma International Airport, Wash., under conditions being considered by the Port of Seattle Commission in its search for a lead base operator to handle a large-scale aircraft maintenance facility at the terminal.

In announcing that bids are being sought from interested operators with a deadline of today for replies to a spokesman for the commission, announcement of the fall, notes that a covering letter being sent to bidders suggests that they include sample lease time schedules within a student flying instruction facility and indicate that the operator would be discouraged from charging to the public.

The successful building operator would be expected to handle, here, maintenance, instrument and accurate overhaul, sale of fuel and lubrication and experience for transient business aircraft and non-scheduled airlines. The report, which the commission released in 1976, notes that the lease had no fixed base operation.

Under terms of the bid solicitation, the port commission would require that the operator erect and equip his own building at a site tentatively chosen by the port—a 100-ft x 145-ft space north of the airport terminal building and adjacent to a highway.

Commission Vice President C. H. Calender has noted that the port will not necessarily enter into negotiations with the firm submitting the highest-price, sealed or minimum rental, but will place equal emphasis on experience, reputation and proposed method of operating the new facility.

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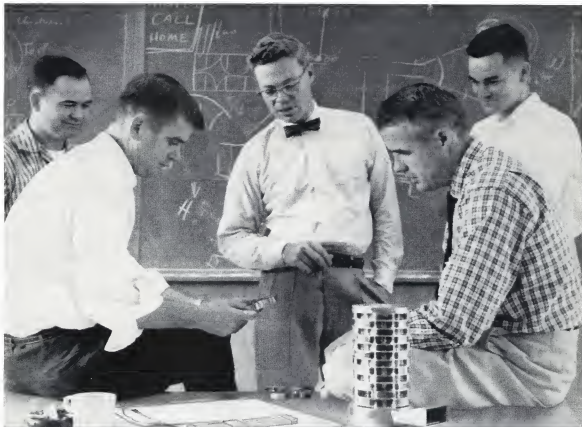
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